How Landscape Conservation Partnerships Are Working to Address Climate Change

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Abstract

Land conservation – defined as land protection, restoration and stewardship – can be used to address climate change both by mitigating greenhouse gas emissions and by helping human and natural communities adapt to the changes caused by global warming. To be most effective, land conservation strategies dealing with climate change need to be implemented at scale and typically require collaboration among many partners who need to work together to overcome obstacles like political boundaries, uncoordinated plans, competition for funding and cultural conflicts. This paper examines the experience of collaborative partnerships in dealing with climate change. The examination draws from a recent online survey of landscape conservation partnerships, interviews with over 40 practitioners, web research, and email communications. The paper presents practices that appear to be most effective and makes recommendations that can accelerate and broaden the benefits of landscape conservation and restoration in meeting climate goals.

Keywords: landscape conservation, conservation partnerships, collaborative conservation, landscape restoration, resilience, climate adaptation, climate mitigation, natural climate solutions

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Shawn Johnson is the Director of the Center for Natural Resources and Environmental Policy at the University of Montana and chair of the Center's graduate certificate program in Natural Resources Conflict Resolution. For the past ten years, he has helped advance a joint effort between the Center and the Lincoln Institute of Land Policy on regional collaboration and large landscape conservation. The joint effort explores questions of policy, leadership and governance at the landscape level, where there is often a mismatch between the scale of an existing challenge or opportunity and that of existing organizations and jurisdictions. Shawn can be reached at shawn.johnson@umontana.edu

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We continue to be inspired by the many landscape conservation initiatives working toward integrating climate science, climate mitigation and climate adaptation strategies into their work. We have learned a great deal and look forward to continuing to learn and share your collaborative work with the larger landscape conservation community.

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The authors welcome feedback as well as suggestions for additional examples of how landscape conservation partnerships are collaborating to promote climate adaptation and mitigation. Please contact kat@largelandscapes.org.

Executive Summary

While regional planning techniques and projects have important precedents going back into the nineteenth and twentieth centuries in the United States, landscape conservation partnerships that focus primarily on fish and wildlife habitat conservation have been widely embraced as useful capacity-building and strategy implementation tools by conservation practitioners and policy makers in the U.S. only in the last several decades, and their roles continue to evolve.
The purpose of this paper is to examine the extent to which landscape conservation partnerships are interested in, planning and building capacity for, and implementing on-the-ground strategies to address challenges related to climate change in the early twenty-first century.

Research and preparation associated with this paper include a recent online survey of landscape conservation partnerships, conducted from December 2021 to March 2022. Respondents represented 263 landscape conservation initiatives from across the nation (internet addresses and anecdotal information indicate that they were located from Alaska to Florida, and from Maine to Southern California). Of that number, 128 respondents indicated that their initiative's primary focus areas include climate adaptation or mitigation or that the partnership relies on climate adaptation plans to inform their work. We can infer from that response that there is **widespread interest** in the impacts of climate change, on an expansive geographic basis, on the part of landscape conservation partnerships in the United States.

From follow-up phone calls with respondents, we observe that, of those who have indicated their primary focus areas include climate adaptation or mitigation, there are dozens of landscape conservation partnerships that are engaged in **ongoing planning or capacity-building efforts** that will help them prepare for the impacts of climate change. Notable examples of such planning and capacity-building efforts include:

- The Nature Conservancy's development of a "Resilient and Connected Landscapes" tool that identifies where habitats for endangered plant and animal species are most likely to be found even as the climate changes;
- Remote sensing on soil health and carbon sequestration and data sharing among ranchers in Montana's Range Management Group; and
- Building a network of locally driven partnerships to overcome growing flood risks in the state of Washington's Floodplains by Design program.

Finally, there are a smaller, emergent number of landscape conservation partnerships that are **currently engaged in addressing challenges associated with climate change with on-the-ground projects**. Notable examples include:

- Facing reduced rainfall and increased evaporation in southeast Arizona, Fort Huachuca Sentinel Landscape partners have secured conservation easements along the San Pedro River that, by one estimate, are avoiding aquifer withdrawals of as much as one billion gallons per year;
- The Delmarva Restoration and Conservation Network is removing structures that impede migration of salt marsh as the sea level rises; and

- The Tri-State Conservation Partnership has aligned the funding of easement programs by the Natural Resources Conservation Service offices in Louisiana, Mississippi and Arkansas, contributing to the restoration of hundreds of thousands of acres of bottomland hardwood forests to create a massive carbon sink.

In the future, we expect that landscape conservation partnerships in the United States will take advantage of the **new opportunities** now available to engage in planning and capacity building, and to implement plans for on-the-ground projects that directly address the challenges of climate change made possible in part by the substantial new funding now offered by the federal government through the Bipartisan Infrastructure Law and Inflation Reduction Act, as well as state examples like New York's Clean Water, Clean Air and Green Jobs bond measure.

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How Landscape Conservation Partnerships Are Working to Address Climate Change

Overview

Climate change poses extreme threats to human communities and to the natural resources that sustain all life. In large regions of the world, drought and extreme heat are drying up rivers, depleting aquifers and reservoirs, killing crops, destroying wildlife habitat, and making traditional lands uninhabitable. As a result, mass human suffering, starvation, and migration are on the rise. At the same time, warmer air can hold more moisture, leading to storms with record-setting rainfall and flooding that cause severe damage to homes, crops, and natural areas. Coastal marshes where marine species spawn are being inundated, imperiling biodiversity and fish stocks that feed the planet. Relationships between human cultures and the land are being disrupted. Whole communities need to be relocated away from rising seas and raging rivers. Indigenous communities that depend on the harvest of native plants and wildlife are losing their food supplies.[1] Farmers and ranchers whose families have worked the land for generations are being forced to abandon their traditional life ways.

To avoid a planet-wide collapse in the ecosystems and natural resources that sustain life on earth, scientific opinion has been converging on the need to limit global warming to an average of 1.5 degrees Celsius. Some regions of the earth – at higher latitudes and elevations – have already exceeded that limit, which is leading to dramatic changes in their natural systems and weather cycles. Minimizing global warming will require simultaneous execution of a broad range of strategies to reduce emissions of greenhouse gases and to promote the capture and sequestration of greenhouse gases that are already in the atmosphere. Collectively, these strategies are referred to as "climate mitigation." Much of the effort to reduce greenhouse gas emissions has focused on the need to wean civilization from its dependence on burning fossil fuels. But that approach alone is insufficient to reduce emissions to the required level, and it does not address the need to recapture the excessive greenhouse gases that have already been released. According to the National Oceanic and Atmospheric Administration, atmospheric carbon dioxide in 2022 reached more than 420 ppm, the highest level in approximately 4 million years (NOAA 2022a).

Large-scale changes to land management are also recognized as an essential climate mitigation strategy. For example, agricultural practices in the United States often rely on heavy application of fertilizer. Not only does the manufacturing of fertilizer release greenhouse gases, but excess nutrients also generate nitrous oxide – a potent greenhouse gas. The impact of 1 pound of nitrous oxide on warming the atmosphere is almost 300 times that of 1 pound of carbon dioxide (IPCC 2007). Not only can different agricultural practices reduce emissions, but the natural landscape

[1] The authors use the terms "Tribe" and "Tribal" to refer to Tribal nations of the continental United States (American Indians) and "Indigenous" or "Indigenous peoples" to include Tribal nations of the continental United States and the tribal nations and villages of Alaska (Alaska Natives). In discussing cross-boundary partnerships, "Indigenous" may also include the First Nations and Métis of Canada. Where possible, we use specific names of nations, bands, pueblos, communities and/or native villages. *Definitions adapted from "Tribal Nations and the United States: An Introduction," by the National Congress of American Indians.*

of forests, grasslands, wetlands, soils, and other plants absorbs these emissions, particularly carbon dioxide – the foundation of all photosynthesis. For example, a recent study concludes that the world's forests provide a "carbon sink" that absorbs a net 7.6 billion metric tons of CO_2 per year, 1.5 times more carbon than the United States emits annually (Harris et al. 2021). Of course, the landscape's function as a carbon sink[2] depends on protecting it from deforestation, urban sprawl, and other land use changes. The landscape's carbon sequestration value can also be enhanced by managing it to maximize carbon absorption – by allowing trees to grow larger before being harvested, by planting cover crops, and through many other proven techniques.

Landscape management can also reduce greenhouse gas emissions by creating trail systems that provide a fossil-fuel-free alternative to automobile use. Parks and street trees in cities reduce ambient temperatures in the summertime, reducing the need for air conditioning.

Even the most optimistic forecasts for reducing and absorbing greenhouse gases foresee a continued rise in net emissions and further warming of the planet. There is no realistic way to turn back the clock on rising sea levels, more powerful storms, greater ocean acidification, and increasing temperatures that are rendering habitats unsuitable for the plants and animals that have occupied them for millennia. The consequences on human and natural communities will be widespread, necessitating major investments to help these communities adapt to changing conditions. While many of these adaptations will require steel and concrete, there is growing recognition that nature-based approaches have a vital role to play. The Federal Emergency Management Agency (FEMA), for example, has made several changes in policy and practice that give greater weight to "living shorelines" that reduce the impact of storm surge, restoration of natural riparian floodplains, and forest management practices that reduce the likelihood and severity of fires. The agency's programs that fund buy-outs of repetitively flooded properties are in growing demand, replacing at-risk homes and businesses with greenspace.

Climate mitigation and adaptation strategies that rely on protection, restoration, and improved management of the landscape are generally not effective if they are introduced haphazardly or on a very localized basis. Protecting a hundred acres of forestland won't make a difference if the unsustainable harvest of lumber is simply displaced to a nearby tract. Restoring a wetland system along a river won't make a difference if a new flood-control dam downstream inundates the wetlands. Nature-based climate strategies must be implemented on a landscape-wide basis, involving entire watersheds, lengthy shorelines, broad prairies, extensive mountain ranges and whole cities.

Yet the whole-landscape approach encounters numerous obstacles. The landscape may be fragmented by political jurisdictions – crossing local, state, and even international boundaries – whose priorities are not aligned and may even be at odds with each other. Plans to protect the habitat of endangered species often stop at the state border and may not match up with the

[2] The world's oceans also function as an enormous carbon sink, leading to acidification and untold damage to marine ecosystems and food supplies. Amplifying the role of terrestrial carbon sinks would relieve some of this pressure.

habitat protection plan of the adjoining state, making it difficult to conserve the corridors that are essential to allow plants and animals to migrate to cooler areas to escape rising temperatures.

Government and private-sector funding programs for land conservation and restoration are often "siloed" into narrow priorities that don't value the importance of conserving other resources. The watershed of even a minor river, for example, may include farmland, forestland, grassland, wetlands, lakes, aquifers, wildlife refuges, hunting areas, mining operations, rural communities, Tribal lands, military installations, and entire cities. Protecting, restoring, and managing that watershed to achieve climate mitigation and adaptation goals – not to mention pollution abatement, public recreation, and cultural conservation objectives – would likely need to draw on a host of federal, state, and local funding programs, regulations, and policies.

A quick view of just a handful of federal funding programs that are focused only on land protection illustrates the complexity of the task:

- The Department of Agriculture funds programs to protect farms and rangeland through the Agricultural Conservation Easement Program of the Natural Resources Conservation Service (NRCS).
- The U.S. Fish and Wildlife Service protects migratory bird habitat through the Migratory Bird Conservation Fund, which supports expansion of national wildlife refuges.
- The Department of Defense protects military installations from encroaching development through the Readiness and Environmental Protection Integration initiative, which creates buffer zones around bases.
- FEMA supports acquisition of repetitively flooded properties, resulting in demolition of improvements and prohibition against future development.

Each of these programs has a different set of rules regarding the resource to be protected; whether protection is through fee purchase, conservation easement, or deed restriction; what entities are eligible for funding; requirements for matching funds; timing of funding awards; whether federal funding is administered through state agencies or a federal bureau, and a host of other considerations. And this is just for land conservation, which is only part of the mosaic of land-based investments and strategies needed to promote climate mitigation and adaptation action.

Often there are calls for federal agencies to coordinate their programs to streamline the delivery of funding and simplify the task of landscape conservation and restoration practitioners "on the ground." But there are good reasons why the Department of Defense is focused on military testing and training and why the Department of Agriculture orients funding to the agriculture industry and the well-being of rural communities. And there are good reasons why they employ different tools to do so. Each of these agencies is funded through different appropriations bills and is overseen by different congressional committees. While some improvements in coordination and delivery of funding may be possible, it is not realistic to expect anything approaching "one-stop shopping," nor is it conceivable that a top-down approach could result in fine-tuned funding decisions that reflect the extraordinary diversity of America's landscapes.

Many proponents of landscape conservation and stewardship in general – along with climate mitigation and adaptation in particular – point to the value of locally-based partnerships that can navigate the welter of government programs and selectively pursue those that are best suited to the natural and human resources of a particular landscape. They argue that coordination of government programs can best be achieved through a bottom-up approach[3] that develops priorities organically through participation of the many stakeholders who represent a wide range of regional interests. By organizing around a landscape, these partnerships use ecological, cultural, traditional and social information to guide their work and build a shared foundation of knowledge to achieve integrated solutions to their community's most pressing issues. Through this integrated approach, durable partnerships are formed, and conservation outcomes are tackled at scale to address some of humanity's most "wicked" problems, including reconciling human activities and biodiversity conservation (DeFries & Nagendra 2017; IPBES 2018).

Conventional conservation approaches – which have often been reactive and piecemeal – have been unable to address some of the biggest threats society faces. The systems-level integrated and collaborative model that landscape conservation practitioners typically employ is increasingly being acknowledged as an approach to combat the challenges of the 21st century (Hebblewhite et al. 2022) – and should be utilized as an approach to one of the greatest challenges we face today – the impacts of climate change. In this era of escalating climate change, connected and protected landscapes are increasingly important to sustain resilience and ensure that today's work continues to be relevant and durable long term (Network for Landscape Conservation 2022). Fundamentally, the complexities of climate change exacerbate the extensive challenges we are already facing, including accelerating habitat loss and fragmentation and amplifying the inequities faced by communities of color (National Oceanic and Atmospheric Administration 2021a).

This paper has been prepared by the Network for Landscape Conservation (NLC) for the purpose of characterizing the contributions that landscape conservation partnerships are making to climate mitigation and adaptation and to reflect on their potential to contribute even more effectively. Throughout this paper, NLC uses the word "conservation" not just to mean land protection, but in the broader sense defined by the American Heritage dictionary as the "protection, preservation, management, or restoration of wildlife and of natural resources such as forests, soil, and water" – except that we would include cultural resources in the definition. Following are the principal sources informing NLC's research:

- A survey of landscape conservation partnerships conducted during the winter of 2021/22 with 263 responses;[4]

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[3] The "top-down" versus "bottom-up" paradigms should not be oversimplified. In practice, federal or state initiatives will be most effective where they have broad and sustained local support and direction. In turn, local collaborations can be difficult to sustain over time without the resources of a federal or state agency or strong nongovernmental organization.

[4] See Appendix.

- Observations and recommendations from two working groups on climate conservation that met virtually in January of 2022 and were facilitated by NLC staff, as part of the "Forum on the Future of Conservation" sponsored by NLC, the U.S. Fish and Wildlife Service and others[5];
- Suggestions from members of NLC's "Coordinating Committee," which comprises some 35 leaders in landscape conservation drawn from government, nonprofit, landowner, academic and philanthropic sectors;
- Interviews with over 40 partnership representatives – most identified through the survey referred to above, and
- Personal knowledge of several NLC staff members who have field experience in landscape conservation as it relates to climate change.

"We do better when we work together."
Tom Vilsack, Secretary of the Department of Agriculture
National Workshop on Large Landscape Conservation
Washington, DC, October 2014

Based on its research, NLC would place landscape conservation partnerships, or networks, into one of three categories (see Appendix, Figure 7 for the breakdown of survey respondents into these categories):

1. Collaborative partnerships are characterized by sharing of values and priorities, as well as collective decision-making;
2. Networks of networks are umbrella organizations that support multiple partnerships of various types;
3. Sponsored partnerships have a lead partner that sets the agenda and typically provides a large share of the resources (science, funding, staff) that animate the partnership.

The Texas Hill Country Conservation Network is a good example of the first category. The Network aims to protect water resources within an 18-county region by collectively conserving 100,000 acres of open space, supporting local bond measures dedicating $400 million to land protection, and forging a region-wide watershed conservation plan. Dozens of members of the Network are participating in the development of the conservation plan, reflecting local, as well as regional, priorities relating to parks, trails, aquifer recharge, and ranchland protection. There is no dominant funder or partner for the Network.

In the northeastern U.S., many individual landscape conservation partnerships have collectively protected hundreds of thousands of acres of land. Going a step further, the Regional Conservation Partnership Network serves as an umbrella that encourages peer learning and cross-boundary collaboration among these partnerships in training, research, and capacity building, serving as a leading example of the second category of partnership.

[5] Other sponsors included the Association of Fish and Wildlife Agencies, the Native American Fish and Wildlife Society and the U.S Geological Survey.

The Migratory Bird Joint Ventures fall into the third category. North America has been divided into 22 regions, and a partnership has been formed in each region to cooperate in implementing the joint venture mission. Although the purposes of the joint ventures are said to include consideration for humans, the principal goal is protection of migratory bird species through research, planning and land conservation. The U.S. Fish and Wildlife Service provides the funding for a coordinator of each partnership.

Throughout this report, NLC will cite examples of how partnerships in each of these categories are advancing climate-related conservation goals. Much of this report will consist of a description of effective practices being used by landscape conservation practitioners that advance climate mitigation and adaptation. But before turning to individual examples, a few overall observations are important.

- The vast majority of landscape conservation partnerships are exurban; they concern themselves with resources in suburban and rural areas. Although the geographies served by many partnerships include urban areas and even entire cities, the climate-change threats that face cities – like extreme heat, flooding, wind damage and their inequitable impacts on urban population groups – are not commonly embraced by landscape conservation partnerships. Even nature-based solutions – like retrofitting parks, schoolyards and rooftops to absorb rainwater – don't typically factor into broader landscape conservation strategies. But there are some exceptions, as noted later in this report.

- Although nearly half of the respondents to NLC's survey (128 out of 263) indicated that climate adaptation or mitigation is a focus of their work, follow-up interviews or review of the partnerships' websites indicated that climate issues were not a leading priority for most of them. By their positive response, in most cases, conservation partnerships are simply recognizing that their work has climate benefits, and they do not exhibit a high degree of "intentionality" in pursuing climate conservation action. In several cases, partnerships that responded affirmatively to the survey's climate questions do not even mention adaptation or mitigation on their websites. (However, as discussed below in the "Communicating climate goals effectively" section, we found that the target audience influences the language used in public-facing materials. Partnerships may choose more neutral language such as the word "resilient" rather than the term "climate change" to avoid alienating some audience members.)

  "Climate [is] always the top 'second thing'…. The ancillary benefit of almost everything we do is some kind of resiliency."
  --Interview with landscape conservation practitioner

- Among those partnerships that truly prioritize climate in conservation project planning, far more are focused on adapting to climate change rather than on mitigation. There seem to be several reasons for this. First, a plurality of partnerships indicate protection of habitat for endangered species is their top priority (see Appendix, Figure 3), and a fair amount of information is available to direct conservation toward resilient landscapes that

> will offer vital refugia in the future as the climate changes. Second, the scale of action necessary to make a meaningful contribution to climate mitigation may exceed the capacity of even the most ambitious landscape conservation partnerships. Third, most government and philanthropic funding programs expect demonstrable results, and the metrics for evaluating carbon sequestration and emissions reductions are expensive to calculate and, in many cases, not agreed upon.[6]

In coming years, it seems likely that landscape conservation partnerships will become far more active in climate conservation – both for adaptation *and* mitigation purposes. For one reason, as the climate crisis unfolds, the need to harness all types of resources for climate conservation purposes will become ever more pressing. As just one example, the Department of Defense's Sentinel Landscapes Program was originally established primarily to conserve land around military installations as a buffer from encroaching development that might interfere with military operations. Recently, the program has begun to emphasize, among other purposes, "sustainable land management practices around military installations and ranges" that "increase climate change resilience" and protect listed species habitat.

Perhaps a more immediate and practical reason for landscape conservation practitioners to get on the climate conservation bandwagon is the enactment of funding legislation that is dramatically increasing the government resources being targeted to this purpose. Late in 2021, the Infrastructure Investment and Jobs Act (also referred to as the Bipartisan Infrastructure Law) was enacted by Congress, providing most of the fuel for what the Biden Administration calls the "America the Beautiful Challenge." This program is channeling $440 million over five years to land conservation projects that include priorities such as landscape resilience and carbon sequestration (NFWF 2022). A year later, voters in New York State approved the state's first environmental bond in 26 years, a $4.2-billion measure that dedicates hundreds of millions of dollars for climate adaptation and mitigation, including: reduction of greenhouse gas emissions from agricultural lands; addressing extreme heat in cities through increased green space; restoration of coastal, wetland and stream restoration to deal with growing flood problems; and $650 million for open space conservation (Grueskin 2022).

The biggest boost in funding will come from the federal Inflation Reduction Act (IRA). According to the Federal Register, "IRA provides unprecedented funding levels targeted to improve soil carbon, reduce nitrogen losses, or reduce, capture, avoid, or sequester carbon dioxide, methane, or nitrous oxide emissions, associated with agricultural production for several NRCS programs. The increased funding levels begin in FY 2023, and rapidly build over 4 years" (Request for Public Input About Implementation of the Inflation Reduction Act Funding, 2022, p. 70771). For example, the IRA provides NRCS with over $18 billion to support farmers and

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[6] For example, in a recent Federal Register notice, the USDA Natural Resources Conservation Service asked for advice on techniques to estimate greenhouse gas emissions reduction and sequestration benefits from its programs.

ranchers in adopting and expanding climate mitigation activities and systems, as illustrated by the following chart:

Program	Total Funding	FY 2023	FY 2024	FY 2025	FY 2026
EQIP	**$8.45 billion**	$250 million	$1.75 billion	$3 billion	$3.45 billion
RCPP	**$4.95 billion**	$250 million	$800 million	$1.5 billion	$2.4 billion
CSP	**$3.25 billion**	$250 million	$500 million	$1 billion	$1.5 billion
ACEP	**$1.4 billion**	$100 million	$200 million	$500 million	$600 million

There is also an additional $1.0 billion going to Conservation Technical Assistance.

Note that the acronyms listed in the table above represent programs of the United States Department of Agriculture's (USDA's) Natural Resource and Conservation Service (NRCS). EQIP is the Environmental Quality Incentives Program. RCPP is the Regional Conservation Partnership Program. CSP is the Conservation Stewardship Program. ACEP is the Agricultural Conservation Easement Program.

NRCS acknowledges that it will need far more support from landscape conservation partnerships in investing these funds. Climate mitigation may become a new headline for many of these partnerships. The IRA also provides major new funding for non-federal forest landowners to support landscape-scale restoration and urban tree planting.

Findings

Regions and communities across the United States will experience climate change impacts in various ways, due to differing atmospheric, geographic, ecosystem, and economic conditions. As a result, landscape conservation partnerships that are grappling with the challenges of climate change may have substantially different technical approaches to mitigate or adapt to climate impacts. Collectively, the work of these partnerships offers a wide range of valuable lessons and model practices that can be identified and broadly applied.

Across the approximately 40 individuals interviewed for this project, many themes emerged that shed light on how landscape conservation practitioners evaluate challenges, identify opportunities, adapt, and experiment with moving conservation forward in a rapidly changing world. Lessons learned include:

- There are no one-size-fits-all solutions to mitigate and/or adapt to climate change at the landscape scale.
- State policy action is often a catalyst for climate action planning.
- Climate vulnerabilities are often interwoven into strategic planning as managers and partners integrate the best available science to sustain their region, species, and/or cultural resources.
- Landscape conservation practitioners use different terms to communicate their climate-informed conservation work depending on the objectives and collaborators of a project as well as the audience being reached.
- Pairing decision-support tools with "how to" guides to translate relevant information to local practitioners is valuable for the many initiatives that lack the dedicated staff capacity to translate science-based decision-support tools and/or climate data.
- Partners are being creative, cobbling together resources and funding to address their specific climate vulnerabilities and opportunities.
- Connectivity is a critical conservation strategy that landscape conservation practitioners are integrating into planning to improve the ecological resilience of a landscape.
- Partnerships are currently focused on adaptation but see the opportunities and potential benefits of incorporating mitigation strategies where appropriate and applicable.

The following sections of this report share examples of how landscape conservation partnerships are engaged in efforts to respond to the challenges of climate change. These descriptions are grouped into two broad categories:

- *How Landscape Conservation Partnerships Are Evolving Their Organizations and Program Mix to Address Climate Change, and*
- *How Landscape Conservation Partnerships Are Taking Action On the Ground to Achieve Mitigation and Adaptation Goals.*

In addition, several descriptions are accompanied by boxed "Spotlight" profiles that offer more detailed information on how initiatives are addressing their specific climate considerations.

How Landscape Conservation Partnerships Are Evolving Their Organizations and Program Mix to Address Climate Change

This paper does not address the general principles for communication, collaboration, and governance that characterize landscape conservation. There is already a great deal of excellent literature on these topics. Rather, we are looking specifically at how landscape conservation partnerships are being managed to promote climate mitigation and adaptation.

Integrating climate science into conservation plans

Acknowledging that climate change is altering the fabric of land and water resources, landscape conservation partnerships have generally expressed strong interest in integrating climate mitigation and adaptation strategies into their conservation planning. Indeed, there is already a document prepared by the Association of Fish and Wildlife Agencies which is freely available online. It is entitled "Voluntary Guidance for States to Incorporate Climate Adaptation into State Wildlife Action Plans and Other Management Plans" (Association of Fish and Wildlife Agencies 2022). The authors advocate that that seven principles be adopted that broadly apply to any landscape conservation partnership:

1. Fully integrate climate change into State Wildlife Action Plans
2. Adopt forward-looking goals
3. Explicitly link actions to climate vulnerabilities
4. Manage for change, not just persistence
5. Consider broader landscapes and longer timeframes
6. Address uncertainty by considering future scenarios and use of adaptive management
7. Engage diverse partners with climate experience and expertise.

The work at the state level, as well as among landscape conservation partnerships, to integrate climate change considerations in long-term strategies, is ongoing. Following are a few examples that illustrate how landscape conservation partners have been working to integrate climate science into their plans.

- The Nature Conservancy has drawn on the expertise of dozens of scientists, working for more than a decade on the "Resilient and Connected Landscapes" project, to create a conservation plan and mapping tool for the contiguous 48 states that anticipates climate changes. The focus of the project is not on conserving ecosystems as they exist today, but to ensure that future ecosystems, perhaps novel ecosystems, will include a diversity of niches, and thereby support a high level of biodiversity. The data from this project can readily be integrated into regional conservation plans.

- Sea-level rise has emerged as a major complicating factor in the recovery effort for the endangered whooping crane in the United States. The crane population in the wild is growing – having recovered from a low of 14 birds in 1941 to over 500 today. They winter in the marshes and adjoining grasslands of the Texas mid-coast. In order for the U.S. Fish and Wildlife Service to down-list the crane from endangered to threatened, the

recovery plan for the species requires that sufficient winter habitat be protected to support a population of 1,000 birds. Currently, 1,094 acres meet that criterion. However, scientists are forecasting that sea level will rise one meter by the year 2100, inundating low-lying areas of the coast. With careful analysis, the service has concluded that more than half of the currently protected habitat will be lost by the end of the century (U.S. Fish and Wildlife Service 2016). The service and its partners now plan to expand the coastal refuge system, guided by a team of scientists who are evaluating the quality of the habitat that will remain and emerge. The service's plan will establish "Conservation Partnership Areas" where a variety of government agencies, nonprofit conservation organizations, and landowners will join the service in implementing the plan.

- Vulnerability assessments have been used to identify threats and prioritize resources and projects to conserve natural communities being impacted by climate change at the landscape scale (Glick *et al.* 2011). The Wisconsin Driftless Area encompasses a 24,000-square-mile region in southwestern Wisconsin and parts of Minnesota, Iowa and Illinois. This landscape is exceptionally biodiverse due to extensive rare habitats, including native prairies. Grasslands are disappearing at an alarming rate, due to human activities, an increase in the invasion of non-native plants, and the suppression of fire on these fire-dependent habitats. Climate exacerbates these issues due to major temperature changes and large-scale flooding events, causing these rare natural communities to become even more vulnerable. The Natural Resources Foundation of Wisconsin (NRF) secured funding to convene a working group of conservation partners to use Conservation Standards, an internationally recognized evidence-based planning framework. This planning tool incorporated existing vulnerability assessments for each of the unique natural communities to identify threats to their biodiversity to advance conservation planning. For more information, see the Spotlight which follows below.

SPOTLIGHT: Wisconsin Driftless Conservation Plan & Rush Creek Project

Location: The Driftless Area encompasses a 24,000-square-mile region in southwestern Wisconsin, along with portions of Minnesota, Iowa and Illinois. This project focused on the Wisconsin portion of this region.

Partnership: The Natural Resources Foundation of Wisconsin (NRF) secured funding to convene a working group including nonprofits and the Wisconsin Department of Natural Resources (DNR).

Need & Goal: This landscape has exceptional biodiversity, with rare habitats such as barrens, native prairie, oak savannas and grasslands. But non-native plants are invading, fires have been suppressed, and grasslands are disappearing at an alarming rate. Most of these problems are being exacerbated by temperature change and flooding. The partners joined to develop a plan that would address such climate change threats.

- **Conservation & Vulnerability Assessment:** The Conservation Standards are an internationally recognized, evidence-based planning framework that provides consistent terminology and methodologies across regions and scales. The framework has been use to incorporate best practices for this effort. This planning tool incorporated vulnerability assessments for each of the critical natural communities to identify threats to biodiversity across these rare habitats. Examples of assessments developed and findings for this region can be viewed on the Wisconsin Initiative on Climate Change Impacts, Climate Change Vulnerability Assessments (CCVAs) webpage.

- **Climate Planning in Action:** Once climate vulnerabilities are assessed, these assessments are shared with partners and then interwoven into strategic planning efforts. By utilizing the Standards' resources, the initiative was able to create situational models that identified conservation strategies to better prepare for climate impacts. Some conservation strategies involved actions such as prescribed burns that would increase the landscape's resilience. Other strategies dealt with land protection, such as conservation easements and financial incentives for landowners to protect and manage their lands. The plan has also initiated invasive species control to manage and restore the prairies and grasslands.

- **Focal Landscapes:** With the plan complete, the team is prioritizing actions that will benefit the most threatened landscapes within the region. Currently, NRF, in partnership with the Wisconsin DNR, is integrating these findings into the Rush Creek Project, the first-ever approach in Wisconsin to implement a climate adaptation project in a grassland ecosystem. Known as the Rush Creek State Natural Area, this 3,200-acre landscape features one of the most extensive dry prairies in the Midwest. Climate change projections suggest that increased temperatures are making the ecosystem less habitable for numerous native species. The goal of this project is to restore and reconnect remnant dry prairies and restore oak savanna and woodlands in the area. To achieve this, partners have adopted the Adaptation Workbook, a process created by the Northern Institute for Applied Climate Science (NIACS). This decision-support tool works to help land management practitioners bridge the gap between climate change information and how this information applies at the scale relevant to their work (NIACS 2022). Using the Adaptation Workbook has helped to bring partners together to secure funding and implement climate adaptation projects.

Climate Action Opportunities Moving Forward: Development of the Wisconsin Driftless Area Conservation Plan has forged a collaborative process that will continue in the region. NRF and its partners will use the plan to guide future conservation efforts in the Driftless Area. The partnership also aims to engage local communities and other agencies that are involved in this region to influence projects like the Wisconsin Great River Road, the state's only National Scenic Byway. Since Rush Creek is a first-of-its-kind project, the partnership aspires to encourage other land managers in Wisconsin to take a similar approach in planning for climate change.

More Information: Wisconsin Driftless Conservation Plan and the Rush Creek Project

Increasing the scale of planning

Observing the dictum that the scale of the solution must match the scale of the problem, plans to address climate change issues often take a broad landscape approach. Practitioners frequently referred to the necessity of a regional approach to identify and prioritize at-risk assets and mitigation opportunities. The goal is to advance climate action where it can produce the greatest benefit, supporting the ecological integrity of the landscape and leading to greater resilience that can slow the effects of climate change (Mitchell et al. 2015).

- The Hampton Roads region of coastal Virginia is facing some of the highest rates of sea-level rise on the east coast, to the point where "impacts of sea level rise are being felt on an almost daily basis in many parts of Hampton Roads" (AECOM 2022 p. 4:39). To create a coordinated regional response, the Hampton Roads Hazard Mitigation Plan

combines six formerly separate hazard mitigation plans. This planning collaboration represented all 22 communities in the Hampton Roads area.

- The Southeast Conservation Adaptation Strategy (SECAS) is a regional conservation initiative that spans the Southeastern United States and Caribbean. SECAS emerged as a response to the unprecedented challenges facing the region's natural and cultural resources from urban growth and climate change. This large-scale planning partnership brings together state and federal agencies, nonprofit organizations, private landowners and businesses, Tribes and universities around a shared vision of the future. The SECAS Southeast Conservation Blueprint stitches together smaller subregional plans into one unifying map – a spatial action plan for achieving the SECAS vision and goal.

Incorporating climate data into decision-support tools

Decision-support tools are increasingly being used by partnerships to make decisions on priorities for protection, restoration and management of individual tracts of land based on the best available climate data. Pairing decision-support tools with how-to guides to translate relevant information to local practitioners is especially beneficial to partnerships that lack the dedicated staff capacity to translate science-based decision-support data into climate-action priorities. Land conservation funders also are beginning to evaluate applications based on climate mitigation and adaptation data.

- New guidance from the U.S. Forest Service regarding Forest Legacy project selection points to an "Added Carbon Sequestration/Climate Resilience attribute… to highlight alignment and interdependence between land conservation and ecosystem function" (Forest Legacy Program, 2022, p. 1). Use of TNC's Resilient and Connected Landscapes tool is one option for applicants to demonstrate the climate adaptation and mitigation value of their Forest Legacy Program proposals.

- The Maine Appalachian Trail Land Trust developed the "Maine Appalachian Trail Geospatial Information for Conservation" decision-support tool. It enables a coordinated approach to land conservation that takes into account resource values and public use. The tool incorporates The Nature Conservancy's (TNC's) Terrestrial Resilience and Connectivity data sets, which estimate the capacity of the land to maintain species' diversity and ecological function as the climate changes (McKinley & Rucker 2020). Currently, work is underway on a second version that will integrate forest carbon datasets to allow conservation organizations to estimate the impact of land protection projects on carbon storage and sequestration. For more information, see the Spotlight which follows.

SPOTLIGHT: Climate Action in Practice: MATGIC Decision-Support Tool

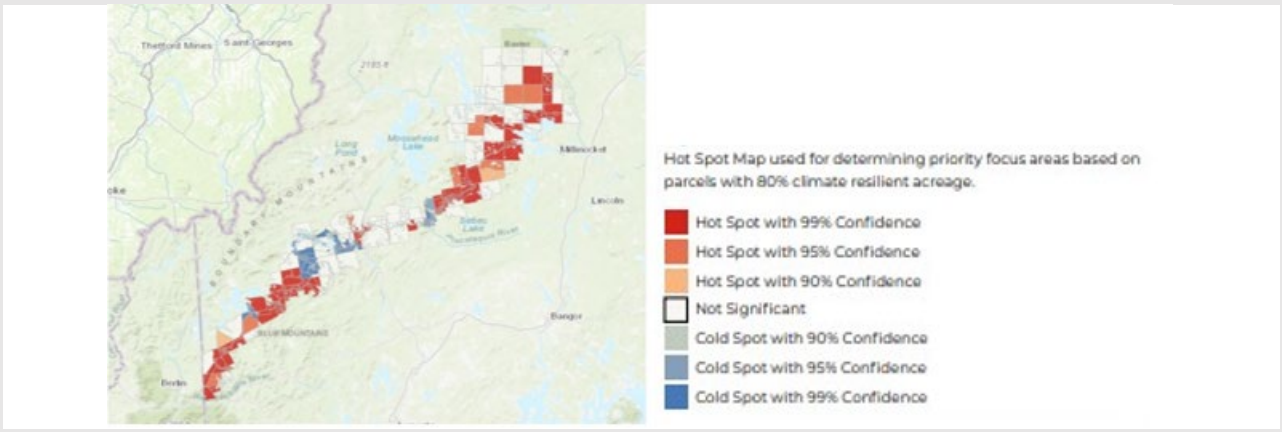
Location: High Peaks Region of Maine

Partnership: The High Peaks Initiative is co-coordinated by the Maine Appalachian Trail Land Trust and an independent consultant. The initiative engages local, regional, and national organizations.

Need & Goal: With a population of over sixty-four million people, the Northeast region of the U.S. is considered one of the highest-density urban coast corridors in the world (U.S. Federal Government 2022a). As a result, portions of this region have seen significant land cover changes, including increased paved surfaces and reduced cover of trees, forests and grassland (U.S. Federal Government 2022a). These impacts on terrestrial ecosystems have cascading effects, leading to an increase in the vulnerability of both ecosystem functions, which will contribute to the overall loss of biodiversity, and lack of resilience in some ecosystems (U.S. Federal Government 2016). Conservation practitioners across the Northeast acknowledge the challenges ahead due to increased development, leading to fragmentation of the landscape, and the increased impacts due to climate change.

This landscape includes Maine's High Peaks region, which contains large, contiguous, undeveloped forest lands above and below 2,700 feet in elevation. Due to this variability, these lands are recognized as highly resilient and core areas for maintaining ecological connectivity across the Northeast, making them critically important for sustaining biodiversity (McKinley & Rucker 2020).

- **Decision Support Tool:** To advance the work of the High Peaks Initiative, the Maine Appalachian Trail Land Trust developed the Maine Appalachian Trail Geospatial Information for Conservation (MATGIC) decision-support tool in collaboration with the Wilderness Society. This tool aims to support a coordinated approach to land conservation, resource management, public access and recreational use. This methodology integrates TNC's Eastern Terrestrial Resilience score and other metrics that estimate the capacity of these lands to maintain species diversity and ecological function as the climate changes (McKinley & Rucker 2020). Work is now underway on Version 2, which will integrate forest carbon datasets to allow conservation organizations to estimate the impact of land protection projects on carbon sequestration potential. The goal of this methodology is to provide partners information to improve strategic prioritization and support greater land protection efforts across this region to maintain its resilient landscape.



- **Range of Data Incorporated:** Priority focus areas were developed to broadly indicate areas most in need of protection to retain the values and characteristics of the Appalachian Trail region in Maine. Those values include views beyond the corridor, natural resource quality, and ecological connectivity, American heritage, visitor experience, and scenery along the trail. This methodology effectively integrates ecological and human-centered (qualitative) values in this decision-support tool. The inclusion of qualitative data is a crucial accomplishment that many initiatives struggle to achieve in geospatial analyses. Climate resilient acreage was one example of how these priority focus areas were developed (see map). The selection of datasets was driven by the strong

community relationships, collaborations, and shared learning that came from the rich understanding of people, places, and history.

- **"Scorecard" for parcel evaluation:** To support practitioners in using this decision-support tool, the Maine Appalachian Trail Land Trust has developed a formatted "scorecard." This scorecard is in narrative form and breaks down the data and analysis of MATGIC to provide more insight to partners on a specific parcel of interest. This supplemental resource is used to help practitioners quickly evaluate a parcel and efficiently prioritize opportunities. These scorecards have been used by partners to integrate into narratives for grants. They have been noted as an effective tool that helps practitioners share their story to funders to justify why resources are needed to protect, maintain or revitalize a parcel. The Maine Appalachian Trail Land Trust has paired its decision-support tools with how-to guides to translate relevant information to local practitioners, creating a helpful resource for initiatives that lack the dedicated staff capacity to translate science-based decision-support tools and climate data.

Climate Action Opportunities Moving Forward: MATGIC is a replicable methodology that reflects the range of social and ecological values relevant to the Appalachian Trail landscape in Maine (McKinley & Rucker 2020). There is an opportunity to work with partners across the Appalachian Trail landscape to integrate this methodology into their land protection efforts, helping to maintain this landscape as an ecological refuge under a changing climate (Halpin 1997; Appalachian Landscape Climate Advisory Group 2022). Regional initiatives, like the Northern Appalachian Trail Landscape Partnership and Staying Connected Initiative, are two examples of collaboratives that work to maintain landscape connectivity and support a collaborative community of practice to share knowledge and resources to conserve, restore, and enhance the Northeast and advance transboundary work into Canada.

More Information: Please visit the following websites:

- Northern Appalachian Trail Landscape Partnership
- Staying Connected Initiative
- High Peaks Initiative

Adopting new technology

Advances in technology like smartphones and videoconferencing have been of tremendous help in supporting the collaborations that underlie landscape conservation partnerships. Many partnerships are now employing emerging technologies to improve their accuracy and response time in dealing with climate change issues.

- The Range Monitoring Group (RMG) in central Montana is a collaborative of ranchers, landowners, agency managers, scientists, academic researchers and nonprofits interested in monitoring rangeland conditions and sharing data to improve land management and ranch outcomes. A small team from RMG is assisting ranchers to track, analyze and share data gathered through remote sensing on soil health and carbon sequestration. The ranchers share their data through a web-based tool soilhealth.app that promotes participatory feedback and learning.

- As Arctic ice melts, more shipping passageways have opened in the Bering Sea, threatening marine mammals. The Aleutian and Bering Sea Initiative of the Northern Latitudes Partnerships has deployed "geofence" technology to monitor transponder signals from large vessels and warn them away when they are approaching haul-outs for walruses, fur seals, and sea lions.

Aligning government funding programs

Government-funded conservation programs typically have focused purposes and restrict eligibility to a narrow class of potential beneficiaries. Landscape conservation partnerships responding to climate change typically include a wide range of partners engaged in conservation of different types of resources, increasing the chances that one of them can meet the funding programs' criteria. Partners are being creative, cobbling together resources and funding to meet their specific climate conservation objectives across their landscapes.

- Founded by the U.S. Departments of Defense, Agriculture, and Interior, the Sentinel Landscape Program's mission is to strengthen military readiness, conserve natural resources, bolster agricultural and forestry economies, and increase climate change resilience. This program is a rare example of funding coordination among federal agencies. The program has recently made resilience to climate change a new priority for the ten landscape conservation partnerships that operate under the program's national umbrella. Sentinel Landscapes are designated in regions where conservation of agricultural lands and biodiversity resources can also contribute to the nation's military objectives for protecting military installations (see the Spotlight which follows).

- Restoring wetlands in the lower Mississippi Valley is a high priority to improve the region's flood resilience and carbon sequestration capacity, in addition to providing vital habitat for migratory songbirds and waterfowl. Seeking to coordinate their programs and strengthen their impact, the NRCS state conservationists from Arkansas, Louisiana and Mississippi joined in forming the Tri-State Conservation Coordination Committee. The Committee was formally chartered by the Lower Mississippi Valley Joint Venture in 2014, and a year later the Joint Venture signed a partnership agreement with NRCS that called for evaluating, synchronizing, and enhancing easement ranking criteria across the three states. The agreement also called for exploring opportunities to more effectively implement and integrate Conservation Stewardship Program and Environmental Quality Incentive Program wildlife conservation practices and funding.

Building on State Initiatives

Many of our survey respondents cited state policies that promote climate conservation planning and benefit landscape conservation partnerships in particular. Several states have developed climate action plans that are the foundation for local and regional plans. Some states go further to require local governments to prepare climate action plans. As these plans are developed, landscape conservation partnerships have the opportunity to urge the inclusion of natural climate solutions and nature-based adaptation measures in the plans.

SPOTLIGHT: Northwest Florida Sentinel Landscape (NWFSL)

Location: 11,306 square miles of Northwest Florida

Partnership: Defenders of Wildlife leads and convenes partners across the region. With over nine Department of Defense installations and ranges that are aggregated into this Sentinel Landscape, there is a robust suite of military partners, as well as other federal and state agencies, nongovernmental organizations and private landowners engaged in the initiative.

Need & Goal: As a coastal landscape, the NWFSL faces increasing climate-related risks, including coastal erosion, flooding and extreme storms. The National Oceanic and Atmospheric Administration's conservative one-foot sea-level rise inundation model predicts that approximately 1.2 million acres of the Northwest Florida Sentinel Landscape are likely to experience flooding over the next 30 years (NOAA 2022b). Coastline and inland landscapes can be severely damaged by extreme weather events, threatening not only military operations but also agricultural and forested working lands and 4,062 square miles of conserved lands that provide habitat for 29 federally endangered, 20 threatened, and two candidate species. To increase the landscape's resiliency, mitigate coastal risks, and adapt to the changing climate, the NWFSL partners are conserving and restoring habitat, investing in green infrastructure to reduce storm and flood hazards, and promoting resilience of water resources.

- **Project Prioritization at Scale:** The NWFSL developed an interactive online map to display partners' priorities and data relevant to the nexus of the military mission and land conservation projects.

- **Identifying Funding to Build Local Capacity:** The NWFSL promotes collaborative efforts that provide greater access to funding, financial incentives, assistance from federal, state and local governments, and private-sector programs to accomplish partners' objectives. These funding programs include the federal Forest Legacy Program, Healthy Forest Reserve Program, Agricultural Conservation Easement Program, Regional Conservation Partnership Program, and Readiness and Environmental Protection Integration Program. State programs include Florida's Rural and Family Lands Protection Program and the Florida Forever conservation program.

- **Communications & Coordination:** Since 2017, partnerships were developed through meetings with federal and state agency staff and other NGOs to discuss how a Sentinel Landscape designation could aid in their mission and contribute to ensuring the success of all partners. A dedicated coordination role staffed within the landscape was essential to build and sustain relationships among partners and convene partners. In January 2022, over two dozen federal, state, and nongovernmental partners executed the Sentinel Landscapes in Florida MOU to provide an organized framework for conservation action.

Climate Action Opportunities Moving Forward: The partnership seeks to capitalize on the recent Sentinel Landscapes designation to improve coordination and access resources and programs to create a network of priority land that will conserve watersheds, wildlife habitat, agricultural lands and community recreation opportunities, while supporting the testing and training missions of Northwest Florida's military installations.

More Information: Northwest Florida Sentinel Landscape

- The North Carolina greenhouse gas mitigation plan concludes "the state will need to work closely with local planning agencies, landowners, and nongovernmental organizations (NGOs) to identify lands suitable for acquisition/conservation easements and funding mechanisms" (North Carolina Climate Action Plan Advisory Group 2008).

- The state of Washington has been providing about $50 million per biennium to support a program called "Floodplains by Design" that aims to reduce the growing risks of flooding from the increasing intensity of storms as well as development in flood-prone areas. The program supports buyouts of high-risk properties, conservation of farms and forests, wildlife habitat improvements along rivers and streams, and land management practices that promote carbon sequestration and reduce land-based emissions. The state funding provides support to the Bonneville Environmental Foundation to serve as a convener and coordinator of locally driven partnerships that carry out the program.

SPOTLIGHT: Floodplains by Design

Location: State of Washington

Partnership: Floodplains by Design (FbD) is a public-private partnership between the Washington Department of Ecology and the Bonneville Environmental Foundation, in collaboration with Tribes, other public agencies, nonprofits and communities.
Need & Goal: While flooding is a natural phenomenon that brings many benefits, Euro-American settlement and growth, combined with climate change and other factors, have led to an increase in the frequency and severity of floods, with harmful effects on Tribal treaty rights, housing, infrastructure and farmland. Floodplains by Design aims to support integrated, multi-benefit projects that build resilient community collaborations to reduce flood risks, restore habitat along Washington's streams and rivers, and protect and improve working lands.

- **Funding:** FbD is funded on a biennial basis by the legislature. In 2021-2023, funding totaled just over $50 million. Typically, state FbD funds are leveraged on a two-to-one basis by other sources, including local, state, federal and private funds. Since inception in 2013, FbD has helped fund the restoration of over 71 river miles, reduced flood risk to over 3,000 structures, protected over 5,000 acres of working lands from development, and supported 63 communities.

- **Locally Driven Partnerships:** Transforming how floodplains are managed on a landscape scale requires collaboration of many interest groups to coordinate planning and investments. The program is carried out entirely through locally driven partnerships, with the Department of Ecology administering the grant program and the Bonneville Environmental Foundation and partners supporting convening, coordination and learning.

- **Tribal Engagement:** Tribes play a central role in many projects, and Tribal support is essential for projects to move forward.

- **Training:** The Bonneville Environmental Foundation also supports a statewide FbD peer-learning group and information-sharing groups around funding, policy and practice.

Climate Action Opportunities Moving Forward: The integrated, multi-benefit projects that FbD support address many priority concerns related to climate change, including carbon sequestration, habitat restoration, reconnection of rivers to floodplains, and flood-risk mitigation. Climate models increasingly inform near- and long-term plans.

More Information: Floodplains By Design

- Since 2004, Pennsylvania's Conservation Landscape Program has been using place-based partnerships to drive strategic investments and actions around sustainability, conservation, community revitalization, and recreation projects. Each conservation landscape is centered around large blocks of state parks and forests in a region where a group of partners promotes a shared identity through conservation of a variety of resources on a landscape scale. Currently, the state program provides "backbone support" for planning and collaboration to eight conservation landscape partnerships.

Crossing international boundaries

The broad, landscape-scale responses necessary for mitigating and adapting to climate change often require cross-border action. Also, policies and techniques pioneered in one country may provide valuable lessons for another.

- Warming trends are threatening the food supplies of Indigenous communities in Canada's Yukon Territory and the state of Alaska. The international Northern Latitudes Partnerships include three partnerships covering three distinct regions across Alaska and northwest Canada. One of the partnerships, the Northwest Boreal Partnership, is engaged in efforts to improve management of declining salmon populations in the Yukon River, which flows through both countries to its outlet in the Bering Sea. (See the following Spotlight for a more complete description.)

- Drought, wildfires and storms are becoming more severe in southern Arizona due to a warming climate. There is intense demand for seeds from resilient native plants to restore damaged areas. The Borderlands Restoration Network operates an expanding native-seed production program and advises groups across the border in Sonora, Mexico, who are aiming to start similar native-seed programs.

SPOTLIGHT: The Northern Latitudes Partnerships - The Northern Connections Program

Location: Alaska and Northwest Canada

Partnership: The Northern Latitudes Partnerships include three partnerships covering three distinct regions across Alaska and northwest Canada. The Steering Committee members and project collaborators include natural resource management agencies, research and academic institutions, Tribes and First Nations, Indigenous organizations, conservation organizations and other stakeholders.

Need & Goal: In the northern and Arctic regions of the US and Canada, rapid environmental change and climate change are impacting lands, waters and wildlife. Indigenous communities that have long-standing and deeply embedded relationships as stewards of these lands and that, in particular, rely on locally harvested, traditional foods are most affected by these sweeping changes. The Northern Connections program aims to support and connect Indigenous-led science and knowledge programs focused on food security, land and water stewardship, environmental changes and climate adaptation efforts in Alaska and northwest Canada. This is achieved through collaborative science and knowledge projects, sharing critical information and resources, relationship-building, and fostering international collaborations.

- **Adaptation & Justice:** The initiative works with its partners on research, knowledge sharing, co-production of knowledge, and climate-smart land and conservation planning to address the impacts of climate change in the region and help sustain Indigenous ways of life connected to lands and waters. Though some of the partners have their own efforts focused on climate mitigation by way of reducing greenhouse gas emissions – keeping oil in the ground and engaging in carbon credit programs – the Collaborative is primarily focused on climate adaptation and supporting Indigenous-led stewardship of lands, waters and natural resources in the region.

- **Working Groups:** Three working groups focus on capacity and funding, data management and data sovereignty, and Indigenous Knowledge. Outcomes from the working groups include: hosting a forum for dialogue among philanthropic funders and Indigenous leaders, creating a guidebook on data management and data sovereignty, and conceptualizing the certification of community-based Indigenous researchers and knowledge holders, similar to academic certifications for western-science researchers.

- **Training:** In addition, the program hosted a six-week training on grant writing and funding strategies for Indigenous-led research and knowledge programs.

Opportunities Moving Forward: The team is currently collaborating with the Indigenous Circumpolar Council and the Exchange for Local Observations and Knowledge of the Arctic (ELOKA) to develop a Network Analysis and update the Atlas of Community-Based Monitoring. The goal is to provide up-to-date documentation of projects across the Arctic to aid community-led programs in learning from each other, leveraging data and knowledge, and potentially creating more extensive coordinated monitoring networks across large landscapes.

More Information: Northern Latitudes Partnership

Advancing environmental justice

The effects of climate change are commonly experienced most severely in disadvantaged communities, often because those communities are located in the most vulnerable areas, but also because they lack the resources to reduce the risks and impacts.

- The Narragansett Bay Estuary Program found that environmental justice communities have about 50 percent more area in flood zones compared to the rest of the region. They also have less tree cover to absorb rainfall and less fiscal capacity to improve flood-control infrastructure. The Estuary Program is launching a 10-year plan for the region with dozens of action plans for work on water, wildlife, and quality of life, each of which has been developed with a focus on racial equity, sustainability, and climate resilience.

SPOTLIGHT: Blackstone Watershed Collaborative - Environmental Justice

Location: Northeast Region: Massachusetts and Rhode Island

Partnership: Collaborative network that comprises 120 organizations, including colleges and universities, federal and state agencies, municipalities, businesses and nonprofits.

Need & Goal: Due to climate change, the Northeast region experiences extreme precipitation events, sea-level rise, coastal and riverine flooding, and heat waves. Increasing regional development pressure exacerbates these impacts and makes climate adaptation planning critical to improve community resilience. Massachusetts and Rhode Island are both acknowledged as states that are devising road maps for climate action leadership (Ricketts et al. 2020). However, small nonprofits and municipalities across these states have minimal capacity to support the implementation of these state resilience efforts. This region is also home to the birthplace of the Industrial Revolution, and as a result, this watershed holds significant environmental justice concerns for all people due to legacy toxins and is of particular concern for communities historically marginalized through colonialism, redlining and other practices (Blackstone Watershed Collaborative 2021). The Blackstone Watershed Collaborative saw a great need to bring diverse partners together to improve the health and resilience of the Blackstone Watershed communities and meet the increasing challenges to water quality, while addressing historic inequities. The Collaborative's climate adaptation work focuses on integrating this historic context and expected climate impacts into planning and development through knowledge sharing, technical assistance, habitat connectivity and culvert assessment.

- **Environmental Justice:** Communities with fewer resources have less capacity for long-term flood planning, and many of the residents of these communities have fewer resources to recover from flooding events. The Collaborative was created to support capacity building in a region that is often overlooked, including communities in its urbanized headwaters and receiving waters, small rural towns, and Indigenous communities who contribute Traditional Ecological Knowledge. The Collaborative is committed to supporting Environmental Justice (EJ) communities and integrates the Narragansett Bay Estuary Program's story map, "Environmental Justice in the Narragansett Bay Region," as a tool for education, outreach and identification of EJ communities in the watershed. The story map is interactive and user-friendly, and it provides a comprehensive look at legacy and compounding impacts on communities such as low tree cover, flooding, proximity to facilities that manage toxic substances, access to protected open space, and more.

- **Federal Support & Training:** The Collaborative has received financial support from the federally funded Narragansett Bay Estuary Program to build capacity and support projects within the watershed such as regional resilience planning and stormwater management improvements. With training from the North Atlantic Aquatic Connectivity Collaborative through the University of Massachusetts Amherst, the Collaborative assesses culverts to identify priority improvements or removals within the watershed. These upgrades help reduce flooding, improve water quality, and enhance public safety.

- **Funding Technical Assistance:** The Environmental Protection Agency's Southern New England Program Network provides funding to partners, including the Collaborative, for technical assistance to support restoration activities, expand the use of nature-based solutions to increase resilience, and identify opportunities to restore water quality and support critical habitats and ecosystems. As a part of this program, the Collaborative works with communities and regional planning agencies to review bylaws and regulations that support sustainable development and stormwater innovation.

Climate Action Opportunities Moving Forward: The Blackstone Watershed Collaborative is working on nature-based solutions, prioritizing green infrastructure and low-impact development to use or mimic nature to manage stormwater and allow communities to use water as a resource rather than a waste product. This watershed is home to many environmental justice communities, and there is great opportunity for reducing the impact of flooding on these communities by thinking at scale, identifying critical open space that exists and protecting it, enhancing cold-water fisheries, and improving connectivity between the waterways across the watershed. To achieve this work, the Collaborative, along with the Massachusetts Municipal Vulnerability Preparedness (MVP) program and Rhode Island's Municipal Resilience Program (MRP), work closely with cities and towns to complete a municipal-driven workshop process that integrates resources like the Mass Audubon's Bylaw Review Tool to bring together climate change information and local knowledge to identify top hazards, current challenges and community strengths. In addition, the Collaborative provides the necessary technical assistance and funding identification support for these communities to accelerate the implementation of the prioritized actions identified during the workshops to result in watershed-wide resilience and water quality improvements.

More Information: Blackstone Watershed Collaborative

- Since 2020, the Regional Conservation Partnership Network (RCP Network) has focused its annual gathering on advancing environmental justice. In 2020 and 2021, the virtual RCP Network Gathering took a critical first step in introducing concepts of land justice and equity to attendees. From there, partners examined conservation organizations' role in integrating this learning to advance land justice. During the 2022 RCP Network Gathering, organizations focused on advancing climate justice and resilience were invited to share their knowledge with this community.

- Average annual temperatures in Baltimore have gone up more than three degrees Fahrenheit over the last century, nearly twice as much as the rest of the country. A report by the Howard Center for Investigative Journalism concludes that the burden of rising

temperatures isn't shared equally. Researchers found that street-level temperatures in the low-income community of East Baltimore were upwards of 9-16°F warmer than the city's leafiest communities, and East Baltimore's residents suffer disproportionately from chronic respiratory illnesses that are exacerbated by excessive heat. The Greater Baltimore Wilderness Coalition supports the work of several tree-planting programs in the region. One partner, the Baltimore Tree Trust, focuses its Trees for Public Health program on East Baltimore.

Respecting and integrating priorities of Indigenous peoples

Landscape conservation strategies typically consider cultural as well as natural resources. The values of Tribes and other Indigenous peoples need to be represented. These values are often at great risk due to climate change. Drawing from Indigenous and Traditional Knowledges connected to the latest science, Tribes have developed sophisticated climate action plans that focus on land protection, restoration and stewardship. A good example is the Climate Change Strategic Plan of the Confederated Salish and Kootenai Tribes of the Flathead Reservation.

- The Floodplains by Design Program supports collaborative partnerships throughout Washington State and awards grants for floodplain restoration, land protection, and habitat restoration. Tribal voices are at the table, and grants are not awarded to projects if Tribes don't support them.

- In northern California, the Western Klamath Restoration Partnership seeks to build trust and a shared vision for restoring fire resilience at the landscape scale. A hallmark of the partnership is the Karuk Tribe's knowledge of fire, passed down from generation to generation. This Indigenous Traditional Ecological Knowledge shows that human/fire relationships developed in the past can guide the climate strategies of the future. Representatives from the Karuk Tribe co-lead the collaborative group.

Communicating climate goals effectively

Landscape conservation practitioners use different terms and strategies to communicate about the climate significance of their work, sometimes because of skepticism about the reality of climate change, or the ability of local land management practices to make a difference. But people who doubt the need for a climate action strategy may, nevertheless, embrace a fire-hazard reduction plan. The need to mitigate carbon emissions may take a back seat to the value of improving the productivity of agricultural soils. Climate conservation strategies also may seem inordinately complex and presenting them in down-to-earth ways can help build support.

> *"We haven't been talking about this or couching [our work] as climate adaptation strategies or [providing] climate benefits. But certainly, you know, the persistence and perseverance of biodiversity depends on connected habitats as biodiversity is pressed by all the associated climate impacts."*
> *--Interview with landscape conservation practitioner*

- The Wildlife Conservation Society (WCS) Climate Adaptation Fund has supported innovative action to address the impacts of climate change since 2011 (including many projects carried out by partnerships mentioned in this report). One project using an effective communication strategy is the "Scaling-Up Adaptation Actions Using Strategic Communications through Beaver Mimicry" project. Rising temperatures, lower snowpacks, earlier spring melt, and multi-year drought in the headwaters of the Missouri River are putting stress on wildlife and water users in the region. Working with private landowners, local conservation districts, and state and federal agencies, their goal was to encourage broader adoption of beaver-mimicry techniques by providing practical, hands-on learning opportunities for relevant decision makers and resource managers to see and better understand the benefits of beaver-mimicry structures. You can find more information on this project and WCS's - Strategic Communication resources here.

- The Delmarva Restoration and Conservation Network (DRCN) has developed an engaging story map that emphasizes the economic value of its work. Each of the Network's three goals has a connection to the economy, citing "industries that rely on Delmarva's natural resources" (Goal 1); support for "fisheries, agriculture, forest products, tourism, and outdoor recreation" (Goal 2); and the "vital network of working and natural lands and waters" (Goal 3). This story map has been used to share the purpose of the DRCN's work and communicate to funders the need to invest in the large landscape and collaborative effort. (See Spotlight for a more complete description.)

Coordinating climate action in cities with regional conservation goals

Although many landscape conservation partnerships cite benefits to urban areas such as protecting municipal water supplies or reducing flood hazards, few of the partnerships interviewed actually work in cities. That may need to change if we are to build broader public support for climate conservation and address disparities in the benefits of conservation programs.

- The Thrive Regional Partnership, together with the Open Space Institute, announced a new program in four cities in Georgia and Tennessee that will help the communities develop natural solutions that can be used to protect against climate change threats such as flooding, urban heat-island effects, and erosion-induced landslides.

- To improve the region's capacity to achieve lasting economic vitality, Greater Baltimore Wilderness Coalition's partners seek to mitigate impacts of climate change, including sea-level rise, flooding, stronger coastal storms, warmer temperatures, and drought through a protected regional nature-based infrastructure network including forests, wetlands, parks, rain gardens and urban tree canopy. The Coalition's Resiliency Maps seamlessly integrate Baltimore into regional climate-resilience strategies.

Scaling success

For landscape conservation to make a meaningful impact on climate mitigation and adaptation, successful models need to be efficiently replicated.

- In 2012, several individual landscape conservation partnerships in New England came together to form the Regional Conservation Partnership Network. The Network encourages peer learning and cross-boundary collaboration among the partnerships, creating opportunities for training, research and capacity-building that benefit all the members, which enhances their collective conservation impact. Today the Network has grown to over 50 partnerships in New England, New York, and the Mid-Atlantic states, with the potential to reach over 1600 municipalities and townships.

- As the realities and future threats of sea-level rise become more pressing, coastal communities are increasingly evaluating managed retreat as a component of their comprehensive adaptation strategies. Over time, landscape-scale retreat along extensive portions of the nation's coasts will become inevitable. In order to share experience and best practices regarding this challenging topic, practitioners have formed the Managed Retreat Network.

SPOTLIGHT: North Quabbin Regional Landscape Partnership - Climate Conservation Planning Pilot Project

Location: A 560,000-acre landscape in central Massachusetts, north of the Quabbin Reservoir

Partnership: The North Quabbin Partnership includes the Harvard Forest, University of Massachusetts, Massachusetts Audubon Society, Trustees of Reservations, state conservation agencies, the National Park Service, U.S. Fish and Wildlife Service, a regional planning agency and several regional and local land trusts. The Partnership also engages municipalities and landowners in its projects.

Need & Goal: The North Quabbin landscape encompasses a tapestry of rolling hills, farmland, expansive forests, wetlands, rivers and lakes. The region includes some of the largest remaining roadless areas in Massachusetts and supports unique ecosystems and animals that depend on large unfragmented forest blocks, like moose, bobcat, fisher and bear. To maintain this region's ecological integrity, the North Quabbin Partnership needed to integrate the best available science into its conservation planning to account for the expected future impacts of the warming climate in the region.

- **Regional Learning Network:** The North Quabbin Regional Landscape Partnership is one of dozens of regional conservation partnerships supported by the RCP Network, which is convened by the Highstead Foundation. Many members of the RCP Network shared a similar interest in modifying their conservation priorities to account for the expected impacts of climate change. To efficiently support these members, the RCP Network offered them a series of training workshops, with the help of TNC, the Open Space Institute and the U.S. Fish and Wildlife Service's North Atlantic Landscape Conservation Cooperative.

- **Co-occurrence Modeling:** Co-occurrence analysis is a method to rank (and visualize) conservation priorities, using Geographic Information Systems (GIS) technology. Areas that have a higher relative value than others are based on how many important conservation features are present or "co-occur." The lands with the highest scores are considered the highest conservation priorities. Two sources of GIS data were made available to RCP

Network members via databasin.org. One was TNC's Resilient and Connected Landscapes data, and the other was a dataset of underrepresented geophysical settings developed by the Open Space Institute. The Highstead Foundation and the North Quabbin Partnership decided to craft a co-occurrence model emphasizing this resilience science.

- **Workshops and Results:** The Partnership held three half-day meetings to make strategic decisions central to the co-occurrence model and agree on elements of a strategic conservation priorities map. This included ranking the importance of each data set/conservation value. The outcome was a revised map of conservation priorities. Several areas that were once considered important to protect no longer ranked high because their conservation values were expected to be significantly compromised by climate change. Other areas in the region were identified as especially important to protect because they demonstrated resilience to the threats of climate change.

Climate Action Opportunities Moving Forward: This prioritization process equipped the North Quabbin Regional Landscape Partnership with knowledge and skill to translate the science of climate change and develop climate-inclusive conservation plans. This process and map stand out as a replicable model, so practitioners can integrate resilience concepts and related datasets in their future work. The Partnership has used this process and product to submit grant applications to advance collaboration and spark new projects at a larger scale while helping communities think – and plan – more broadly about the future of the North Quabbin landscape in a changing climate.

More Information: North Quabbin Regional Landscape Partnership and NQRLP & Highstead Final Climate Conservation Planning Pilot Report

How Landscape Conservation Partnerships are Taking Action On-the-ground to Achieve Mitigation and Adaptation Goals

This section of the paper turns to the specific on-the-ground protection, restoration, and stewardship practices that landscape conservation partnerships are implementing to carry out mitigation and adaptation strategies. Many of these techniques are being coordinated and implemented over geographies of unprecedented scope.

Sea-level rise and storm surge

Rising seas and coastal storms, particularly, threaten the Atlantic and Gulf coasts of the U.S. Partnership responses range from a focus on vulnerable facilities to ecosystem-wide strategies.

- For the Delmarva Restoration and Conservation Network (DRCN), coastal resilience is a high priority due to the immediate impacts the coastlines in this region are experiencing. Maintaining a salt-marsh buffer is essential for resilience, and that will require salt-marsh ecosystems to move inland. The DRCN is identifying and removing impediments like culverts, riprap, and in-stream barriers.

SPOTLIGHT: Delmarva Restoration and Conservation Network (DRCN) – Promoting Coastal Marsh Migration

Location: Delmarva Peninsula, which encompasses portions of Delaware, Maryland and Virginia.

Partnership: Local land trusts, state and federal agencies, and national conservation organizations.

Need & Goal: The stretch of coastline from the tip of the Delmarva Peninsula in Virginia to Cape Cod, Massachusetts, is experiencing the greatest increase in the rate of sea-level rise globally: 2 to 3.7 mm per year – more than three times the global average (U.S. Federal Government 2022a). In 2017 the Delmarva Restoration and Conservation Network (DRCN) came together to develop a Strategic Restoration and Conservation Action Plan. Climate change is already affecting Delmarva's people, economy, culture, fish and wildlife. A primary focus of the strategic action plan was to address the combined impacts of increased development and sea-level rise. This plan aims to identify the most important places to protect and restore and to obtain support and funding for voluntary restoration and conservation to protect the rural Delmarva landscape for people and wildlife.

- **Strategic Action Plan + Business Plan:** This plan was the first of its kind to look at the entirety of the Delmarva Peninsula. The Strategic Action Plan is part Conservation Design, identifying the most critical places to restore and conserve to achieve a network of ecologically important and resilient habitat hubs and corridors, and part Business Plan, describing how the DRCN will work together and obtain funding for on-the-ground restoration and conservation. The DRCN Delmarva Network Map is publicly available to all interested.

- **Prioritizing Salt Marsh Migration:** Currently, coastal resilience is a high priority due to the immediate impacts these coastlines are experiencing. To maintain a resilient coastline, salt marsh ecosystems will need to move inland. To address these coastal resilience challenges, the conservation design framework evaluated marsh migration zones, fish passage, in-stream

barriers, and coastal habitat and submerged aquatic vegetation vulnerability. Practitioners across this landscape can use this information to identify the critical coastal habitat at risk and the actions necessary to support a connected and more resilient coastline in the face of future development and climate change.

Communications: To engage partners, decision-makers and the public, a story map was created at the very beginning of this effort before the final Strategic Action Plan was published. This communication tool was effective in articulating the importance of this effort and set in motion significant interest from Congress and substantial funding opportunities.

Climate Action Opportunities Moving Forward: Essential to the effort's success was utilizing communication tools like the story map and pairing that with national conservation organizations who have the lobbying capacity to articulate to Congress the importance of conserving this landscape. Now, innovative new funding programs are available, including the recent "Chesapeake Watershed Investments for Landscape Defense program" or Chesapeake WILD, signed into law in 2020 and funded in 2022. This program looks to support effective networks to achieve strategic conservation action on the ground for wildlife conservation and environmental equity (U.S. Fish & Wildlife Service 2021). The DRCN partnership identified this funding as a critically important opportunity and resource to support their regional planning efforts at scale. To achieve this goal, this funding focuses on increasing science capacity to enable improved strategic planning, conservation design, monitoring and applied science activities to ensure the resilience of natural ecosystems and habitats.

More Information: Delmarva Restoration and Conservation Network

- In May 2021, a group of regional government and military officials in the southeastern U.S. launched the South Atlantic Salt Marsh Initiative, with the objective of conserving a one-million-acre stretch of coastal salt marsh from North Carolina to northeast Florida. The goal is to protect open lands adjoining salt marshes, allowing tidal wetlands to migrate inland as the sea level rises.

- One of the key goals of the Northwest Florida Sentinel Landscape is to identify and scale gray and nature-based infrastructure solutions that mitigate coastal risks. Nowhere was the risk made more evident than at Tyndall Air Force Base, which sits on a peninsula with forty miles of shoreline on the Gulf of Mexico. The base experienced $5 billion in damage from Hurricane Michael. Sentinel Landscape partners are now collaborating on nature-based coastal-resilience projects involving building and reinforcing enlarged dunes, sediment placements, and creating a "living shoreline" – an oyster-reef breakwater and the planting of seagrasses, which together will break wave energy and absorb floodwaters in vulnerable areas. There has never before been a coastal-resilience project of this scale at a military installation.

Inland flooding

A warmer atmosphere holds more water vapor, increasing the volume of rainwater and leading to overflowing rivers. Rivers commonly cross jurisdictional boundaries, requiring a partnership response.

- A 2021 Needs Assessment for the Blackstone River Watershed developed by the Narragansett Bay Estuary Program prompted the formation of the Blackstone Watershed Collaborative. With increased flooding linked to climate change, the Collaborative is targeting green infrastructure and improved management of culverts to areas at greatest risk.

- Washington State's Floodplains by Design program is restoring natural riverine processes by reconnecting rivers with their floodplains – buying out properties with buildings that are repeatedly flooded, moving levees further away from river channels, restoring meanders and wetlands that slow and absorb floodwaters, and planting native vegetation.

- The Lake Superior Collaborative (see Spotlight following) supports and promotes climate resilience practices in northern Wisconsin through information sharing, collaborative planning and prioritization, and securing funding that supports mutually beneficial projects. Faced with more intense storms that cause erosion, siltation, and nutrient discharge into the lake, the collaborative emphasizes a broad strategy that maintains and enhances the function and resilience of watershed headwater features, streams, forests, and wetlands.

Forest health

Threats to forests due to climate change impacts include drought, wildfire, and introduction of invasive species. Dying forests generate carbon emissions, contributing to global warming, and threaten the wildlife and human communities that depend on them. On the other hand, where it's possible to maintain or restore healthy and resilient forests, they promote a thriving ecosystem and can sequester tremendous volumes of carbon dioxide.

- In April 2022, the U.S. Forest Service announced a commitment of $30 million over 10 years to the Rio Chama Collaborative Forest Landscape Restoration Program, which brings together four national forests and the Two Watersheds, Three Rivers, Two States [New Mexico and Colorado] Cohesive Strategy Partnership. The program aims to reduce the risk of catastrophic wildfire by decreasing tree densities and restoring low-intensity fire regimes to the landscape.

- In areas of the western Oregon Cascades where forests have already burned, Sustainable Northwest leads a partnership that helps forest landowners recover through seedling sourcing, reforestation, restoration of wildlife habitat, and improved forest management planning.

- In the Northwest Florida Sentinel Landscapes Partnership, as land protection partners acquire land to prevent development that would be incompatible with military operations, land stewardship partners are restoring a longleaf pine forest ecosystem that provides climate-resilient habitat for a host of threatened and endangered species.

SPOTLIGHT: Lake Superior Collaborative - Slow the Flow

Location: Great Lakes region

Partnership: Collaborative includes partners from state, Tribal and federal agencies as well as nonprofit organizations, local governments and academic institutions.

Need & Goal: In the Midwest, extreme rainfall events have increased over the last century – a trend that is expected to continue. Increased precipitation compounded with land use and land cover changes in the region is already contributing to flooding, coastal and upland erosion, along with a decline in water quality. The changing climate will exacerbate a range of risks to the Great Lakes region, including infrastructure damage, changes in species distribution and emerging concerns like increased instances of harmful algal blooms. In the Wisconsin portion of the Lake Superior watershed, regional partners formed the Lake Superior Collaborative because they recognized a need for coordinated efforts to protect and restore the landscape to achieve a long-term vision of climate resilience.

- **Natural Flood Management:** Collaborative partners established the state's first natural flood-management demonstration project. This approach, with its emphasis on nature-based approaches to hydrologic restoration, could be applied elsewhere in the Lake Superior basin and the Great Lakes region at large.

- **Best Management Practices:** Local partners have been working to "slow the flow" for many years. Current efforts continue this work to strategically implement practices that prevent accelerated runoff and associated nutrients and sediment from urban and rural nonpoint sources. This includes stabilizing stream bluffs to reduce sediment movement and conducting assessments to replace culverts in order to improve aquatic organism passage and create more resilient hydrologic systems, roads and built infrastructure.

- **Shared Action Planning:** Collaborative partners each have individual roles based on their organizations' mission and geographic purview, however, working in partnership necessitates a coordinated approach to achieving watershed-scale resilience. Partners contribute to the goals set forth in the Lake Superior Lakewide Action and Management Plan or "LAMP" and created their own five-year action plan that features actionable goals specific to the local Wisconsin context. Partners also pursue Nine Key Element Watershed Plans for sub-watersheds within the Lake Superior basin of Wisconsin.

- **GLRI Funding:** Since 2010, the Great Lakes Restoration Initiative has accelerated efforts to protect and restore the largest system of fresh surface water in the world. GLRI provides funding to 16 federal organizations that strategically target the biggest threats to the Great Lakes ecosystem and fund projects that accelerate progress toward achieving long-term goals for Great Lakes ecosystems and communities.

Climate Action Opportunities Moving Forward: The Collaborative will continue supporting climate change initiatives that increase the Lake Superior ecosystem's resilience in habitats, species and communities**.** Importantly, there is an emphasis on sustaining relationships with partners, landowners and a range of governmental entities to maintain and enhance the function and resilience of watershed headwater features, streams, forests and wetlands.

More Information: Lake Superior Collaborative & project story map

- The Lower Mississippi River Valley provides critically important wetland habitat for wintering waterfowl and forest-breeding birds, but a vast amount of the land has been cleared or drained for farming. Today, many agricultural operations are no longer profitable. The Tri-State Conservation Partnership offers landowners the opportunity to sell conservation easements to NRCS, which then restores the wetlands. Hundreds of thousands of acres of bottomland hardwood forest have been restored through this program, creating a massive carbon sink.

Water resources

All life on earth depends on water. Climate change is dramatically changing patterns of rainfall, with too little rain in some places and too much in others. Observed impacts include increased agricultural runoff and water pollution, widespread drought, loss of agricultural productivity, destruction of wildlife habitat, and even mass migration of human populations as their traditional lands can no longer support them. Understanding and responding to hydrologic change requires concerted action by landscape conservation partnerships.

- Stretching from Mexico through Arizona, the San Pedro River supports a vibrant ecosystem, local human populations, and critical training operations at the U.S. Army's Fort Huachuca. For years, rapid development in the region has increased demand for water, while climate change has reduced rainfall and increased evaporation – leaving portions of the San Pedro River dry. In response, Fort Huachuca Sentinel Landscape partners forged an initiative that protects aquifer recharge areas with conservation easements. Detention basins and recharge cells then funnel stormwater into the ground. Over its five-year lifespan, the partners have permanently protected over 6,000 acres of land along the desert river, which one estimate suggests avoids one billion gallons of potential groundwater pumping per year.

- Students at the University of Michigan School for Environment and Sustainability are pursuing a project titled "Sustaining Freshwater Services" to anticipate climate and development changes within the Obtawaing Biosphere Region. Scheduled to conclude in April 2023, the project will engage several biosphere region partners to focus on hydrologic systems and water resources as aspects of regional and local sustainability planning. Learn more about the United States Biosphere Network.

Plant and wildlife habitat

Changes in temperature, availability of food and water, and seasonality have been observed to render habitats inhospitable. To some extent, adaptation measures can counteract these impacts.

- The Nature Conservancy's Southern High Plains Initiative aims to conserve a network of lands and waters that will boost climate resilience to benefit an extraordinary diversity of endemic plant and animal species. The initiative brings together conservancy leaders and partners from across five states to foster conservation progress in a 71-million-acre region. With a 2022 commitment of $10 million from the NRCS Regional Conservation

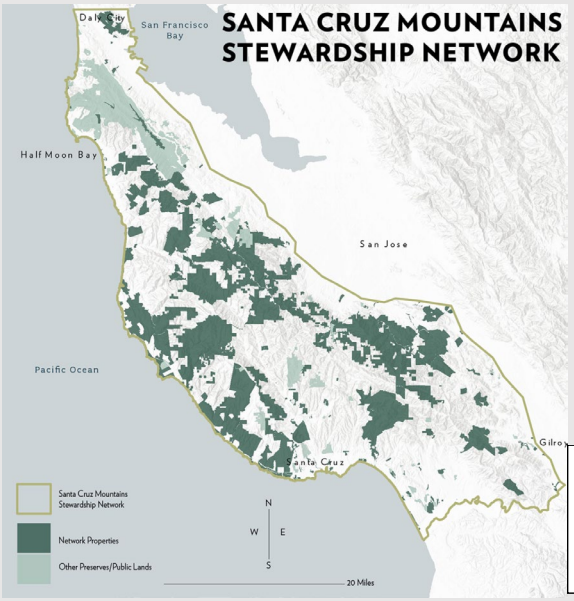
Partnership Program, the partnership will explore the use of carbon emission reduction projects, specifically those preventing the conversion of native grassland to cropland, as a method of matching NRCS investment in long-term conservation practices (U.S. Department of Agriculture 2022).

"For some of our focal landscapes, we're really at the stage of trying to understand what the [expected] impacts of climate change are on those certain landscapes. Our role is different in each of those different focal landscapes."
--Interview with landscape conservation practitioner

- California's Santa Cruz Mountains Stewardship Network launched its Climate Adaptation Project to improve understanding of climate impacts and reduce climate-related risks to important habitats and species within the region. Project partners conducted vulnerability assessments that identified 10 essential habitats and 10 focal species to prioritize adaptation measures. For more information, see the Spotlight below.

SPOTLIGHT: Climate Action at Scale in California: Santa Cruz Mountains Stewardship Network & "Cutting Green Tape"

Location: Central coast of California. Located in the San Francisco Bay area, this region is just south of San Francisco and encompasses the Santa Clara Valley to the east, extends to the Pajaro River to the south, and is bounded by the Pacific Ocean to the west. This landscape contains diverse ecosystems, including natural features ranging from ridge tops to alluvial fans, old-growth forests, saltwater lagoons, marshes, mudflats, and intertidal zones.



(Map courtesy of Santa Cruz Mountain Stewardship Network and Golden Gate National Parks Conservancy, Accessed: https://baynature.org/article/what-stewardship-looks-like-in-the-santa-cruz-mountains/)

Partnership: To work across a patchwork of management jurisdictions with the goal of maintaining this biodiversity-rich landscape, the Network engages over 24 different organizations, including Tribal nations like the Amah Mutsun Tribal Band, nonprofits, state agencies, and the U.S. Department of the Interior Bureau of Land Management.

Need and Goal: California is well known for its diverse ecosystems and the severe impacts that climate change is producing across this state. According to California's Fourth Climate Change Assessment (2019), the state has seen temperatures rising, a decrease in snowpack (2023 being an outlier), increasing sea-level rise, a greater frequency of drought, and an increase in wildfire activity. To monitor and manage these impacts across diverse ecosystems and communities, California is prioritizing regional coordination, cross-sectoral engagement, and capacity building to continue to evaluate progress, assess challenges, and identify knowledge gaps and needs for future research. Different regions within California are taking major steps to create and implement adaptive strategies to bolster resilience so that natural systems maintain desirable ecosystem function and built systems can withstand and adapt to changing conditions. Public health, safety and risk to the economy must be minimized for all people and communities (California's Fourth Climate Change Assessment 2019).

The Santa Cruz Mountains landscape is changing rapidly due to severe climate impacts, such as increasing temperature, sea-level rise, and intensifying forest fires. As a result, there are growing threats to the biodiversity of this region. To address these concerns, the Network's mission is to collaborate and share knowledge to aid in the creation of implementation plans to effectively integrate adaptation strategies. Their work seeks to cultivate a resilient, vibrant region where human and natural systems thrive for generations to come.

- **Creation of the Climate Adaptation Project:** To achieve this, the Santa Cruz Mountains Stewardship Network partnered with Pepperwood and EcoAdapt – organizations that specifically focus on ecosystem-climate research, climate adaptation strategies and implementation – to create the Santa Cruz Mountains Climate Adaptation Project. Three different workshops were developed to involve and integrate resource manager expertise from the Midpeninsula Regional Open Space District and stakeholders in the Santa Cruz Mountains Stewardship Network. During these workshops, the participants used a critical eye to assess what the region's natural systems are facing.

  To begin this project, partners were asked to describe the habitat or species within the project area and assess how vulnerable each is to climate change. They also assessed how adaptable they felt the habitats or species are to change. Partners narrowed their focus to 10 critical habitats and 10 critical species and assigned either a high, moderate or low sensitivity to change and adaptive capacity. Based on this workshop EcoAdapt then assigned rankings to climate exposure based on downscaled climate projects for the region. The overall ranking for each component was converted into high, moderate or low scores, which led to generating an overall score determining vulnerability in the region.

  These workshops generated a collaborative vulnerability assessment, a foundational document that identified practical applications for stakeholders to incorporate information into their management plans for on-the-ground projects. This report continues to guide managers in integrated vulnerability data into management and conservation plans, programs and projects. For more detailed information on the development of this plan, please visit the Santa Cruz Mountains Climate Adaptation Project EcoAdapt webpage.

- **Funding and Capacity Constraints:** The Santa Cruz Mountains Stewardship Network's role is to support, connect, and provide opportunities for collaboration. They support initiatives to come together and create strategies to achieve a more resilient landscape. This includes securing funding to aid in climate action, which is a huge barrier for networks to navigate. As Dylan Skybrook, Network Manager, shares, "...funders want to support concrete projects. They want shovels in the ground and want to know what they're getting. They are not always willing to fund operational funds or things that seem bureaucratic. Networks are all about getting people together to talk and share information." Connecting is paramount for networks to keep stakeholders engaged and bridge knowledge and resources. Still, such an abstract concept of building relationships and knowledge can prove difficult to fund. Dylan states, "if the network is not truly intentional and careful about identifying opportunities to collaborate across boundaries, this work becomes kind of a side project or hobby for network member representatives, unless we figure out how that collaboration can also benefit the projects our partners are working on."

  Lack of capacity is another major barrier the Santa Cruz Mountains Stewardship faces. Many network participants are not paid for their partnership work and have careers, jobs, or other priorities that occupy them day-to-day. Coordination capacity is critical to navigate shared opportunities and keep participants engaged in intentional work needed to maintain steady momentum toward shared goals and outcomes.

- **Support from a Statewide Network:** There is a crucial need to understand climate change and implement diverse strategies to aid in navigating climactic impacts on multiple scales and in different regions. Due to that need, the Santa Cruz Mountains Stewardship Network actively participates in a larger network to help support not only their own initiative, but to contribute and aid in supporting multiple collaboratives, organizations, and networks in the whole state of California. The California Landscape Stewardship Network (CLSN) is the giant umbrella that connects, supports, and aims to shift the paradigm of the state's general approach and understanding of climate change. CLSN creates a place to share resources, change limiting systems, and works to solve problems that many face on the ground when conducting landscape conservation work. A major approach the network takes is to build awareness of the value of working on a landscape scale and find ways to increase support for this work from funders, state leaders, and policymakers around the state.

Climate Action Opportunities Moving Forward: To prioritize cross-boundary collaborative work and navigate major barriers, such as coordination capacity and funding, CLSN launched a system-change effort called "Cutting Green Tape" in 2019. The primary goal of this initiative is to improve permitting and funding efficiencies for ecological restoration and natural resource stewardship. To support this effort, CLSN convened five visionary and action-oriented roundtables between December 2019 and April 2020. Over 150 regulatory agency staff, local governments, NGOs, public and private landowners, Tribes and other interested parties developed specific recommendations for how to increase permitting effectiveness, expedite project review and approval, improve cross-jurisdiction collaboration, and more (CLSN, 2021). These workshops resulted in a final report, Cutting Green Tape: Regulatory Efficiencies for a Resilient Environment. Statewide webinars continue to be regularly held in collaboration with California Secretary for Natural Resources Wade Crowfoot and partners to discuss the report's recommendations, hear from practitioners and agency leadership, and advance this initiative across the state. CLSN continues to address barriers at different scales, critically engage in sound research, and foster the development of relationships with

community and state leadership to identify ways to be more inclusive and effective. This work is essential to maintain resilient whole landscapes and effectively accelerate and streamline climate action across jurisdictions at scale.

To learn more about these networks, please visit the following websites:

- Santa Cruz Mountains Stewardship Network
- California Landscape Stewardship Network

Connectivity

As another response to climate-induced changes in habitat, landscape conservation partnerships are increasingly employing connectivity[7] as a strategy to improve the ecological resilience of a landscape while benefiting biodiversity and managing land use impacts.

"...at the end of the day, you might have the most beautiful 1000-acre site. But if it's not connected to anything, you've created an island that just increasingly is vulnerable and threatened and degraded."
--Interview with landscape conservation practitioner

- The Appalachian Trail Landscape Partnership (ATLP) is one of the largest landscape conservation collaboratives in the East. Co-coordinated by the Appalachian Trail Conservancy (ATC) and the Appalachian National Scenic Trail unit of the National Park Service, this partnership seeks to "connect the wild, scenic and cultural wonders of the Appalachian Trail (A.T.) and its surrounding landscape" (Appalachian Trail Conservancy 2023). ATC, as coordinating partner for the ATLP, commissioned a Climate Advisory Group to develop a strategic recommendations report to assess the impacts of climate change across the A.T. landscape and management opportunities for this region to serve as a climate corridor. Completed in 2022, this report highlights the need to connect and protect resilient lands across the Appalachian region to maintain the ecosystem function and biodiversity of this globally significant landscape to mitigate and adapt to the impacts of climate change. The ATLP's recent "Three-Year Strategic Plan 2022-2024" further elevates the importance of communicating these findings to increase partnership commitment to strategically work together to ensure connectivity across this landscape.

- More than 460 partners have joined forces to pursue the bold vision of the Yellowstone-to-Yukon Conservation Initiative. "Connectivity" is the theme – protecting migration corridors and allowing for the northward movement of native plants and animals as this giant ecosystem experiences the impacts of climate change. By working with willing property owners, the partnership has helped advance 500,000 acres of private land

[7] Ecological connectivity is defined as "the unimpeded movement of species and the flow of natural processes that sustain life on Earth." (UNEP/CMS/Resolution 12.26 Improving ways of addressing connectivity in the conservation of migratory species)

conservation in key wildlife linkages (Y2Y). To make roads safer for people and animals, the initiative advocates for infrastructure to keep wildlife connected. With more than 117 existing wildlife underpasses, overpasses, and fencing, the Yellowstone-to-Yukon region has more crossing structures than anywhere else in the world (Y2Y).

- In order to better integrate the resilience of humans and wildlife and cultural survival into landscape-level conservation planning, the Nez Perce Tribe, in collaboration with NGOs and university partners in Oregon, Idaho, and Montana, convened the Blues to Bitterroots Coalition in 2019 and developed Camas to Condors, a landscape-scale climate resilience initiative. The initiative is focused on connectivity for wildlife, restoring habitats that support traditionally harvested plant foods, and increasing the availability of traditional foods to the Tribal community. This partnership shares a multi-objective approach to grow an ethical, inclusive, and adaptive restoration economy across a critical wildlife mega-corridor. Their focal region is critical to animal movement, foundational to thriving culture, and rich with refugia that animals, plants, and people will continue to rely on as the climate changes (see the Spotlight which follows).

Reducing greenhouse gases

Eons ago, photosynthesis created the enormous stores of fossil fuels whose burning powered the modern era, releasing tremendous amounts of carbon dioxide back into the air. Photosynthesis is still the only proven option for large-scale removal and storage of atmospheric carbon. Protecting and restoring the capacity for this vital process will require large-scale conservation action. Landscape conservation practices can also prevent the release of greenhouse gases.

- Pennsylvania's Farmland Preservation and Climate Change Mitigation project is combining farmland protection investments with soil-health practices that enhance carbon absorption. Project partners will model the greenhouse gas benefits with COMET-Farm, a tool developed by Colorado State University in conjunction with NRCS that estimates the "carbon footprint" of farm/ranch operation and evaluates different options for reducing greenhouse gas emissions and sequestering more carbon.

- An October 2022 report from the Institute for Transportation and Development Policy found that a citywide network of protected bicycle lanes in a middle-income city can prevent the emission of tens of thousands of metric tons of CO_2 equivalent greenhouse gases every year. The Great Rivers Greenway is a regional agency created by a vote of the people in St. Louis City, St. Louis County, and St. Charles County in the year 2000 to levy a sales tax dedicated to parks and greenways. Through partnerships with hundreds of municipalities and civic groups, the Great Rivers Greenway collaborates to build and care for an off-road network of bicycle and pedestrian trails, with over 128 miles developed to date.

SPOTLIGHT: Blues to Bitterroot Coalition / Camas to Condors Project - Restoring Relationship

Location: The region of interest encompasses the Blue Mountains ecoregion in the interior Pacific Northwest, the Bitterroot Mountains across what is now known as the Montana state line, and the Salmon, Clearwater and Tucannon River Subbasins, across what is now known as central Idaho – all within the Nez Perce Tribe's usual and accustomed areas.[1]

Partnership: Nez Perce Tribe (also known as the Nimi'ipuu), in collaboration with NGOs and university partners in Oregon, Idaho and Montana

Need & Goal: As a result of climate change, the Northwest is experiencing flooding, landslides, drought, wildfire and heat waves. Tribes and Indigenous people, whose cultures, lifeways and subsistence depend on maintaining relationships with land, waters and other species across their homelands, often experience the most severe and immediate effects of these impacts. Partners across the Nez Perce Homeland recognize that Traditional Ecological Knowledge is integral to remembering and sustaining healthy relationships across landscapes and between people and the land, but most conservation practitioners are not well equipped to adequately consider cultural impacts and outcomes in their climate adaptation strategies. In order to better integrate the resilience of humans and wildlife and cultural survival into landscape-level conservation planning, the Nez Perce Tribe, in collaboration with its partners, convened the Blues to Bitterroots Coalition in 2019 and developed Camas to Condors (C2C), a landscape-scale climate resilience initiative.

- **Mission & Vision:** The mission of Camas to Condors is to "Build culturally relevant conservation power in our home region. Develop and share a holistic vision for climate + cultural + ecological resilience. Grow an ethical, inclusive, and adaptive restoration economy / a healing economy" (deVillier et al. 2021). To achieve this, C2C Partners work to co-design, propose, fund and implement proactive, landscape-scale conservation actions and activities to protect and restore land, waterways, wildlife, plants, fish and communities. In 2021, the Tribe issued a formal resolution guiding the partnership's work to empower traditional knowledge keepers in conservation work and leadership, and to integrate Traditional Ecological Knowledge and cultural survival into conservation planning and activities. These actions and activities are designed holistically and equitably, to support climate resilience, ecological integrity, and cultural survival, and include monitoring, stewardship, restoration and education.

- **Connectivity & Food Systems:** The Coalition is focused on connectivity for wildlife, restoring habitats that support traditionally harvested plant foods, and increasing the availability of traditional foods to the tribal community. Qém'es in Nez Perce, or "Camas," is a blue flower with a starchy bulb that historically served as a seasonal dietary foundation of many Indigenous people of the Columbia Plateau. Restoration and protection of camas serves myriad other species who depend on healthy soils and functional hydrology. C2C partners believe that sustaining the ancient cultural relationship between an Indigenous community and their whole ancestral homeland is a conservation strategy. This strategy acknowledges that humans who are intimately interdependent with their land base are an umbrella species. One C2C initiative is the Seasonal Round Trail Project: a monitoring and restoration corridor across the seasonal gradient of Nez Perce Homeland. Along the trail, Native gatherers will tend and restore ancestral harvest sites and monitor climate and management impacts on their foods. For the Nez Perce, every trail was a food trail.

- **Holistic Restoration:** C2C is focused on restoring keystone species and ecosystem processes to benefit all interdependent beings in Nez Perce Homeland. Restoring wet meadows and riparian areas will provide habitat for camas (and many other culturally important species), sequester carbon, and filter and cool streams to support the resilience of other climate-vulnerable cultural keystone species, including salmon. Once abundant in the region, by 1987 the California Condor population was reduced to 22 individuals due to hunting and poisoning from predator removal campaigns, rodenticides, and spent-lead ammunition in carcasses and gut piles. The Tribe is leading the effort to restore this critically endangered species to this corner of its native range: weaving the threads of a healthy landscape back together.

  Education & Workforce Development: C2C aligns with the Nez Perce Tribe's Climate Adaptation Plan; C2C partners aim to create a climate-resilient homeland while healing relationships between people and the land. To build a workforce of culturally grounded Tribal members in natural resource management fields, C2C provides learning opportunities, culturally based educational curricula, and job training for community members. Known as the Wéetespeme Stewardship Program, this initiative is the Nez Perce Tribe's first youth conservation corps – employing Indigenous youth, young adults and mentors to support the Nez Perce Tribe and C2C's efforts in land stewardship, climate adaptation and monitoring in Nez Perce Homeland. For more information on the Wéetespeme Program, contact Tiyana Casey.

Climate Action Opportunities Moving Forward: Camas and condors represent the ecosystems that have sustained the Nimi'ipuu people since time immemorial. The C2C initiative recognizes that the Nimi'ipuu have been responding to climatic changes since the last ice age and have survived massive human disruptions and dispossessions over the previous two centuries. Western and Indigenous communities are brought together in this Coalition to secure traditional food sources and ensure long-term climate resilience for these valuable ecosystems. This partnership shares a multi-objective approach to grow an ethical, inclusive and adaptive restoration economy across a unique wildlife mega-corridor. Their focal region is critical to animal movement, foundational to thriving culture, and rich with refugia that animals, plants and people will continue to rely on as the climate changes. To achieve their multi-objective, approach the partnership continues to actively support projects that contribute to the larger C2C vision. Consider these two examples.

- Rural Cinema: Hitéewinix Á'la Film Series, sharing films on Indigenous sovereignty and Tribal-led climate adaptation and land stewardship while using a solar-powered cinema. Hitéewinix Á'la translates roughly to "sacred fire," which represents the use of fire to manage forests and important gathering sites for the Nez Perce/Nimi'ipuu. Initially funded by Working Films. For more information contact Meadow Wheaton.

- Títooqa Hipt: First Foods Monitoring Program along the seasonal gradient of Nez Perce Homeland. For more information contact Andrea Whiteplume.

C2C recognizes that any work to protect or improve resilience in large landscapes requires robust collaboration and trust-building across diverse ownership and management paradigms. Focusing on restoring relationships, this initiative has shown that building resilience must start with a foundation of trust to achieve a whole-systems restoration for resilience, justice and cultural survival.

More Information: Story Map: Camas to Condors - Whole-Systems Restoration for Resilience, Justice, and Cultural Survival

Recommendations

Whether or not communities explicitly recognize climate change as the cause, almost all communities are talking about climate change impacts. Whether suffering from prolonged drought or another 500-year flood two years in a row, climate change is not just a global issue but is now a local and regional reality. Action is needed at the local, regional, and national levels, and the integration of landscape conservation strategies and the natural solutions the landscape conservation community can provide and implement at scale must be considered and supported as part of the climate solution to mitigate and adapt to our changing climactic conditions.

The landscape conservation community provides a network of opportunities to achieve enduring, locally driven climate action at scale. Often landscape conservation practitioners are already doing the work – building the relationships, identifying the conservation impacts, and working to integrate climate mitigation and adaptation strategies into their collaborative conservation planning efforts. Based on the authors' interviews and survey of landscape conservation partnerships, we offer several recommendations that can make landscape conservation even more effective.

Strategically communicate landscape conservation as a natural climate solution.

Communicating about complex landscapes is challenging to begin with and integrating dimensions of climate adaptation or greenhouse gas mitigation can make it even more so. A good communications strategy always starts with identifying the audience, what that audience needs to hear, and the best way to reach them. A web-based story map may be a good tool for building support among the general public. On the other hand, convincing a hazard mitigation officer to embrace nature-based solutions is more likely to require a dispassionate economic analysis of nature-based vs. gray alternatives. (See for examples the Environmental Protection Agency's Green Infrastructure Cost-Benefit Resources.) Engaging local leaders is always a critical first step to understanding their climate-related concerns and identifying potential connections and opportunities.

> *"We communicate priorities and purpose with technical terms and detailed maps, but the general public is more likely to first engage through stories and illustrations that build emotional connections with the place and its multiple values. We need to continue to build skills in telling compelling stories."*
> Participant at the National Workshop on Large Landscape Conservation
> Washington, DC October 2014

Incorporate climate considerations into all forms of landscape conservation plans, and turning this around, incorporate landscape conservation into all forms of climate action plans.

Partnerships should develop conservation plans and protection priorities that explicitly address climate change. In addition to adaptation, partnerships should incorporate mitigation goals, especially given the upcoming Inflation Reduction Act funding and its emphasis on climate mitigation. Practitioners should review their landscapes to identify:

- Sources of greenhouse gas emissions that could be reduced through conservation action;
- Areas that serve as carbon sinks and need to be protected; and
- Opportunities to increase sequestration through restoration or improved management.

And looking from the other direction, landscape conservation practitioners should actively promote the benefits of landscape conservation in every forum that is generating plans to achieve climate priorities.

Develop decision-support tools to guide climate conservation actions.

Resources of time, money, and political will are always in short supply. It's essential to allocate these resources to the best projects. In our interviews, the authors repeatedly heard that landscape conservation coordinators struggle with capacity constraints and do not have the bandwidth or know-how to integrate climate considerations into the work of the collaborative. Decision-support tools that incorporate climate data can make analyzing and ranking choices much more feasible. In some cases, a how-to guide may even be necessary to simplify the process of using the tool.

Consider the value of connectivity.

As temperatures rise, flooding becomes more severe, and other climate change impacts alter local conditions, animals and plants need to move to survive. Corridors of protected land will become increasingly essential to allow for gradual movement to new locations. Every landscape should be evaluated for its potential role in promoting ecological resilience through a connectivity strategy.

Develop better methods for calculating or estimating the climate benefits of conservation.

One of the greatest obstacles to the use of conservation to achieve mitigation and adaptation goals is the difficulty of measuring the benefits. If a form of clean energy can substitute for the burning of a certain quantity of fossil fuels, the carbon benefits can be calculated with some precision. On the other hand, calculating the carbon benefits from avoiding a major forest fire is much more challenging. Projecting the aquifer recharge impact from a wetlands restoration project involves more uncertainty than building a dam that will impound a river's flow. The cost of measuring the sequestration of carbon resulting from improved forest management is so high that the sale of offsets often doesn't generate a net return. Better, faster, less-expensive protocols for quantifying adaptation and mitigation benefits arising from conservation actions would give them a tremendous boost and lead to better choices in expending conservation resources.

Support landscape conservation partnership coordination.

The key to successful landscape conservation lies in communication among partners and collaborative decision-making to achieve a high level of synergy. Science capacity is needed to support improved strategic planning, conservation design, monitoring and adaptive management

activities to advance climate change adaptation and natural climate solutions at the landscape scale (U.S. Fish & Wildlife Service 2021). Partners and communities need support to apply for and manage government funds – a need that has grown significantly with the establishment of several new state and federal programs. The authors repeatedly heard that landscape conservation initiatives lack the capacity to make the best use of partnership resources and funding opportunities. To improve the delivery of resources and funding for climate action at the landscape scale, we offer a few recommendations:

> *"What worries me most is there's all of these federal dollars and state dollars… which can include resilience.…there's not the capacity to spend all this money."*
> *--Interview with landscape conservation practitioner*

- Federal government support for landscape conservation coordination should be made more broadly available. Models like the National Estuary Program and the Sentinel Landscapes Program demonstrate that modest investments in capacity represent money well spent.
- The same is true for state governments. Despite years of successful operation, no other state has followed Pennsylvania's lead in supporting landscape conservation partnerships. (Washington State's support to collaborative floodplain conservation does offer some similar benefits.)
- Government grant programs should underwrite capacity, collaboration, monitoring, and evaluation of the grant-funded work.
- Support is needed for communities that have experienced historical inequities of disinvestment and are most at risk of climate impacts. This could enable their participation in regional climate conservation strategies.

Integrate climate resilience data into funding applications.

Use of TNC's Resilient and Connected Landscape data to support Forest Legacy Program applications illustrates how climate considerations could influence funding decisions. Widespread adoption of climate priorities in funding decisions would drive resilience at the landscape scale.

Reinvent natural hazard mitigation policy and programs and scale up funding.

As climate-related disasters increase, the United States needs a comprehensive, effective response to minimize loss of life and economic damage. Although FEMA increasingly recognizes the value of nature-based investments in minimizing hazards, its approach is still piecemeal. It lacks the policy framework and funding levels to underwrite large-scale landscape transformation and buyouts of repetitively damaged properties should not take an average of five years. In coastal areas, the Corps of Engineers continues to invest heavily in beach and dune restoration in areas that will be underwater before the end of the current century.

Expand and leverage the capacity of landscape conservation networks.

Networks have clearly demonstrated their effectiveness and efficiency in promoting climate conservation. In some cases, they serve as intermediaries in getting policy changes and funding "to the ground," and in almost every case they serve as learning hubs, sharing scientific advances and best practices among their members. Networks can serve existing landscape conservation partnerships and they can incentivize formation of new partnerships.

Conclusion

Communities are experiencing the full effects of climate change and are suffering the consequences. Conservation practitioners are working hard to use the best available science and integrate climate considerations into their projects across the country to achieve more resilient communities and landscapes. Landscape conservation is a model for creating innovative collaborations that generate significant value for protecting, restoring, and managing the nation's land and water resources. The collaborative approach is particularly important for addressing the challenge of climate change, which requires action across large and complex landscapes.

Coming years provide a window of opportunity for landscape-based climate action. Intact corridors can be protected, allowing for migration of threatened species of plants and animals. Coastal plains can be set aside in anticipation of rising sea levels. Aquifer recharge zones can be restored to increase infiltration of desperately needed water. Farms and ranches can be managed in ways that improve productivity and absorb atmospheric carbon. In this paper, we have shared just a few examples of innovative work and progress in integrating climate considerations across various landscapes in the United States. Greatly expanded federal and state funding provides significant opportunities to make progress toward global goals like 30x30, biodiversity and climate targets. The landscape framework is the appropriate scale to create the building blocks for a continent-wide movement to integrate systems-level solutions to the systems-level challenges we face. Landscape conservation is a valuable and scalable approach to accomplish a more sustainable future.

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[8] To provide further context, usual and accustomed (U&A) places to include fishing, hunting, gathering and cultural-use places encompass areas as far west as the mouth of the Columbia, as far north as the Columbia watershed in Canada, the Northern Rockies up into Canada, as far east as Montana and into buffalo country around Yellowstone. Not one person at the Tribe understands the full extent of Nez Perce Tribe's U&A because it depends on each family. The Nez Perce Treaty of 1855 allows Nez Perce Tribal members to hunt, fish and gather in Oregon, Washington, Idaho, Montana and Wyoming. The Nez Perce Treaty includes water rights and access as well as many food and land use relationships and is said to be one of the strongest treaties in the nation. The US Constitution states that the treaties are the supreme law of the land. As a result, the Nez Perce Treaty can be enforced when the Tribe feels called to in order to protect an area of their homeland. This treaty is supposed to protect the entire Columbia River watershed.

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Appendix: 2022 Landscape Conservation Survey Summary

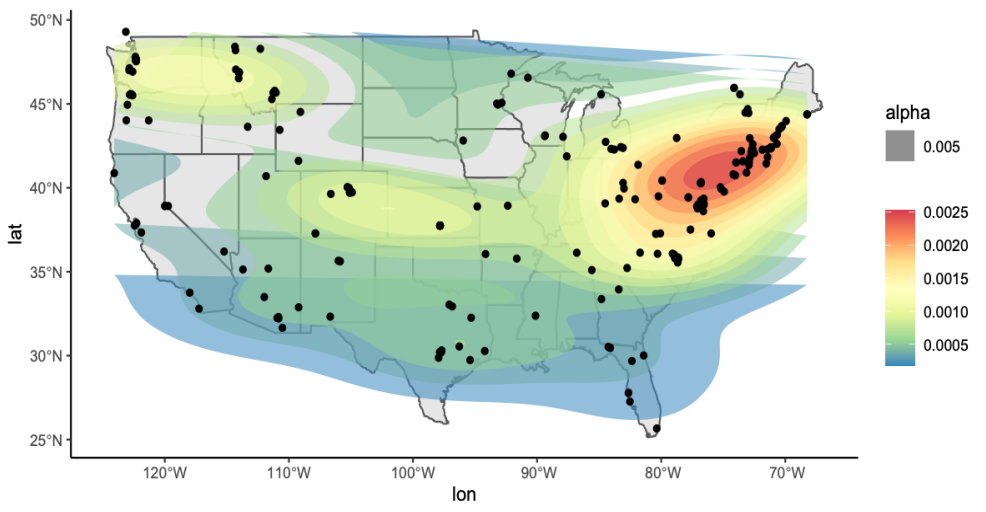
In December 2021, the Network for Landscape Conservation (NLC), in partnership with researchers at the University of Montana (UM), launched an in-depth survey of North American landscape conservation initiatives to collect data across regions. Data was collected from December 2021 through March 2022, and 263 landscape conservation initiatives responded.

One hundred twenty-eight of the respondents indicated that their initiative's primary focus areas include climate adaptation[9] or mitigation[10] or that the partnership relies on climate adaptation plans to inform their work and were selected as potential interviewees for this working paper.

While individual responses to this survey are confidential, this chapter summarizes the survey data relating to climate work. Please note that this report and the survey itself are representative, more than comprehensive: many existing and emerging initiatives undoubtedly have not been captured and certain regions may be underrepresented.

Geographic Distribution of Respondents

Figure 1: Geographic Distribution of Respondents According to IP address

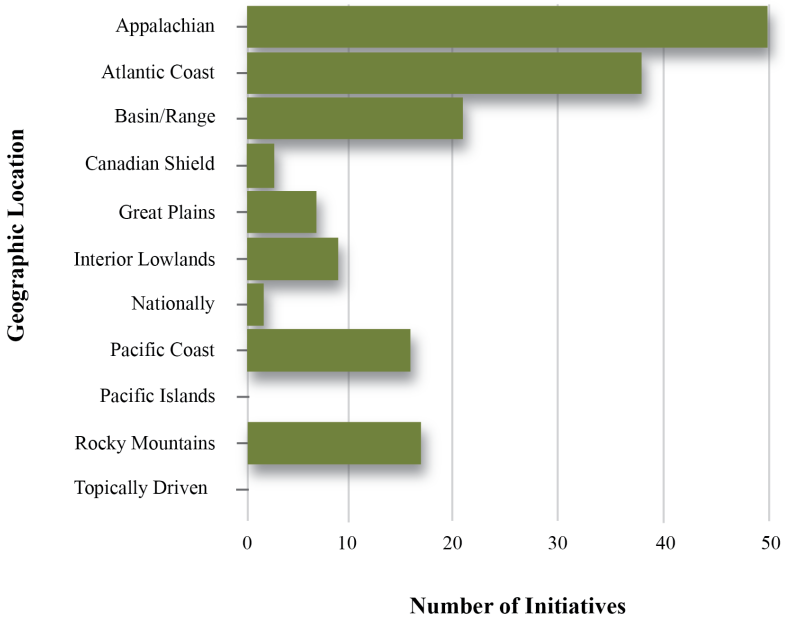


[9] *Adaptation* is defined as the process of making adjustments in natural or human systems in anticipation of or in response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects. Examples of climate adaptation include building flood defenses, planning for heatwaves and higher temperatures, and improving water storage and use.
(Executive Order 13653; NOAA, 2021)

[10] *Mitigation* is defined as the reducing emissions of and stabilizing the levels of heat-trapping greenhouse gases in the atmosphere. Climate mitigation examples include enhancing carbon sinks (such as forests, wetlands, and soils) that accumulate and store greenhouse gases (NASA, 2021)

The above image is a map indicating the geographic distribution of respondents to the 2022 NLC survey. Participants were asked to identify any states and/or provinces that coincided with their landscapes. This heat map shows the intensity of responses by region with increasing numbers as colors shift from blue to green to yellow to red.

Figure 2: Number of Survey Respondents by Geographic Region



2022 Landscape Conservation Survey: Summary of Results

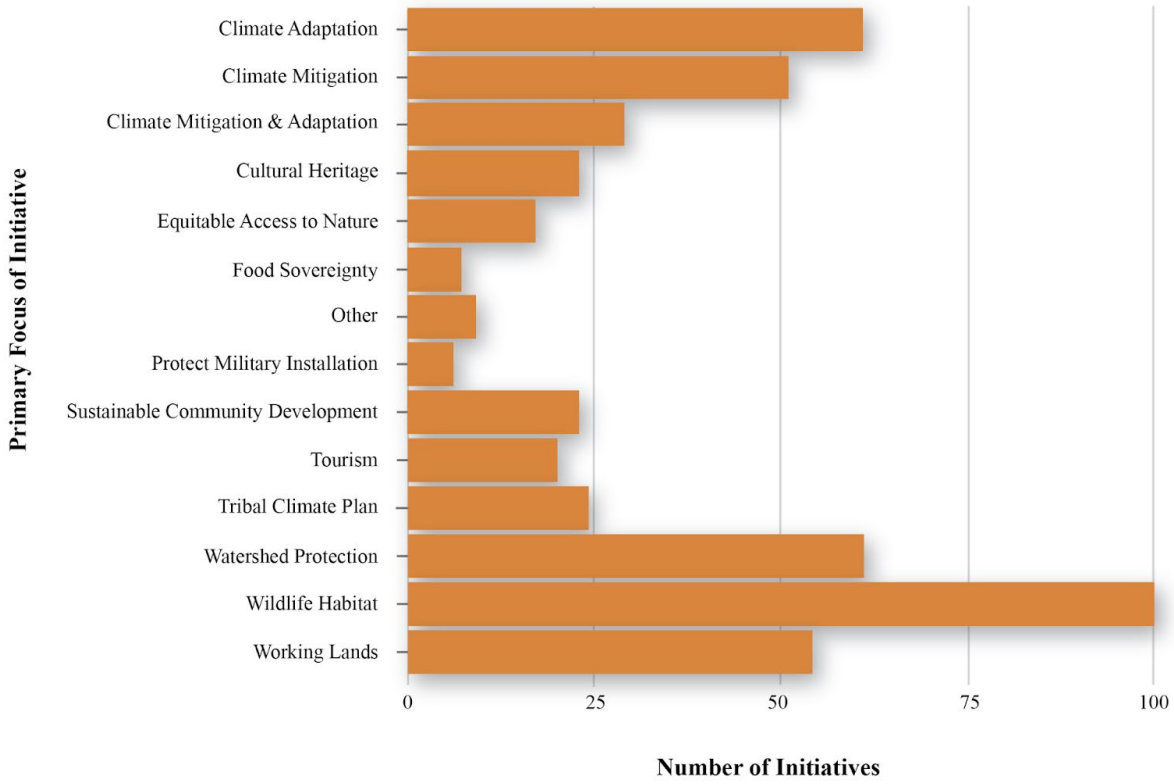
The 2022 survey consisted of 27 multiple-choice, rank-order, and open-ended questions. The summary below highlights key climate-related results from the survey.

Primary focuses of initiatives' climate work

Question: Identify the primary focus areas or goals of your landscape conservation initiative, checking all that apply (options: open space for outdoor recreation; habitat, wildlife, and biodiversity conservation [including wildlife connectivity/corridors]; watershed protection for water quality and supply; cultural heritage and/or historical resources; equitable access to nature; tourism and scenic values; working lands [for example, agriculture, fishing, timber, and/or grazing]; climate change mitigation [for example, Nature-based Solutions]; climate adaptation [for example, forest/wildfire management, flood management, etc.]; sustainable community development; land justice and/or Tribal sovereignty; food security/sovereignty; protecting military installations or operations; other)

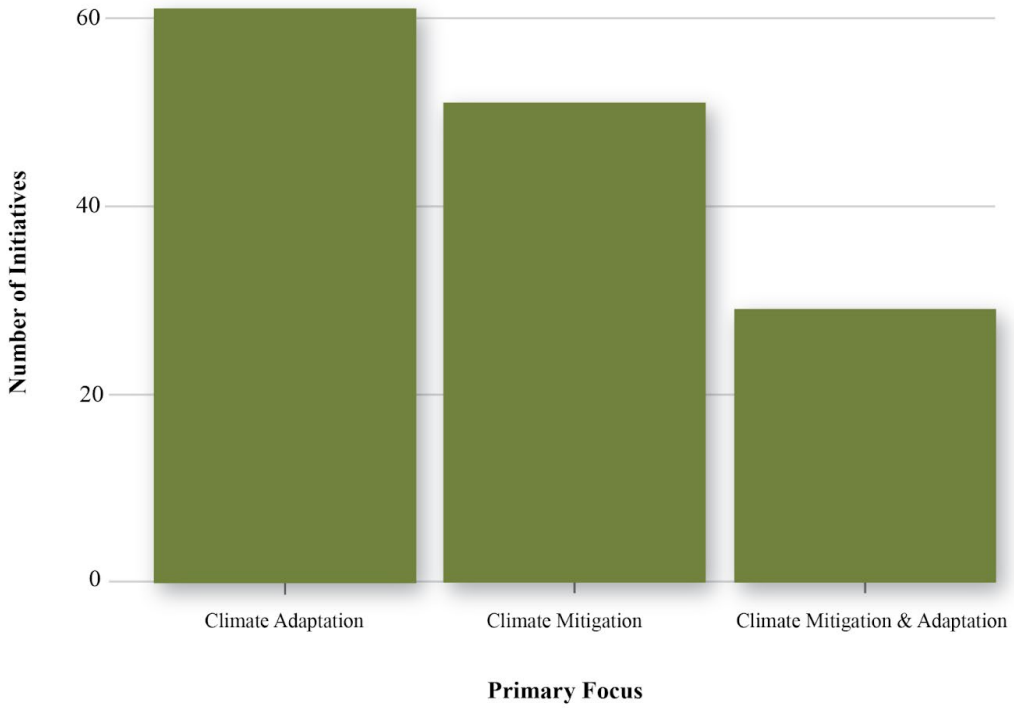
Of the initiatives that indicated they are integrating climate (mitigation, adaptation, or planning), wildlife habitat was identified as the most common primary focus and was selected by 93 percent of initiatives. Watershed protection (56 percent), climate adaptation (56 percent), working lands (50 percent), and climate mitigation (47 percent) were also common primary focuses of the surveyed initiatives.

Figure 3: Primary Focuses of Initiatives That Indicated They are Integrating Climate Work.



Of the initiatives that indicated that climate work (adaptation or mitigation) was a primary focus of their initiative, climate adaptation was the most common (56 percent), followed by climate mitigation (47 percent), with initiatives that selected both climate adaptation and climate mitigation as a primary focus as the least common (27 percent).

Figure 4: Primary Focuses Related to Climate Work (Adaptation, Mitigation, and Both) of Initiatives that Responded to the 2022 Survey.



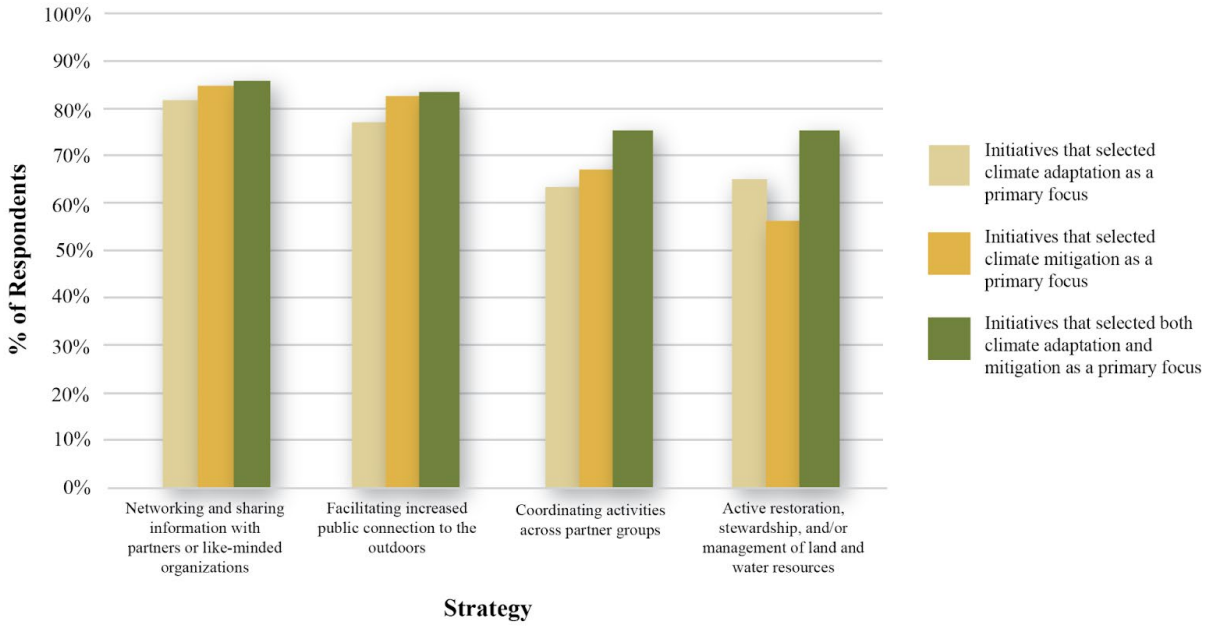
Primary strategies for climate adaptation and mitigation

Question: Identify the primary strategies and tools that your landscape conservation initiative pursues to achieve its goals and objectives, checking all that apply (options: facilitate strategic conservation planning; land protection through acquisition and easements; land use planning; distribute funding via grants; networking and information- sharing across partners and/or like-minded organizations; storytelling, public education, and/or campaign-building; targeted community engagement (for example, private landowners, key community leaders); technical assistance and capacity building; research, data collection, and analysis; active restoration, stewardship, and/or management of land and water resources; conflict resolution; foster a sense of inclusion and belonging; legislative or policy advocacy; coordinate activities across partner groups; facilitate increased public connection to the outdoors; other)

All of the subgroups (initiatives that selected climate adaptation of climate mitigation as a primary focus; initiatives that selected climate adaptation as a primary focus; initiatives that selected climate mitigation as a primary focus; and initiatives that selected both climate adaptation and mitigation as a primary focus) indicated that networking and sharing information

with partners or like-minded organizations was the most common primary strategy for their work, followed closely by facilitating increased public connection to the outdoors, coordinating activities across partner groups, and active restoration, stewardship, and/or management of land and water resources.

Figure 5: Primary Strategies of Initiatives That Responded to the 2022 Survey.

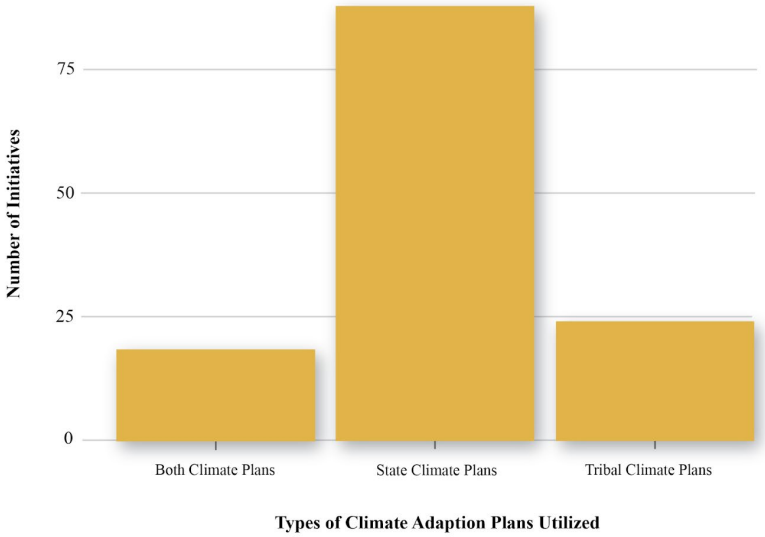


Use of climate-specific plans

Question: Do you utilize any of the following in advancing your landscape conservation initiative's work? Select all that apply. (Options: State wildlife action plans, State Forest action plans, State comprehensive outdoor recreation plans, State hazard mitigation plans, State climate adaptation plans, Tribal climate adaptation plans, Tribal agricultural resource management plans)

Of the climate specific plans, state climate adaptation plans were more commonly utilized by survey respondents (81 percent of respondents) than Tribal climate adaptation plans (22 percent of respondents). Only 17 percent of respondents indicated that they utilize both state and Tribal adaptation plans to advance their initiatives work.

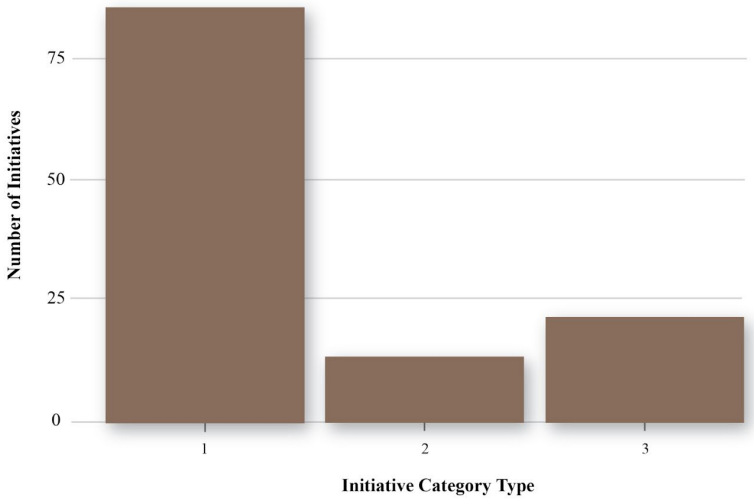
Figure 6: Types of Climate Adaptation Plans Used by Initiatives That Responded to the 2022 Survey.



Classification of initiatives

Based on the initiatives' responses to various survey questions, each initiative was classified as one of the following: 1 = Collaborative Partnership (initiative that relies on shared values and priorities as well as collective decision-making); 2 = Network of Networks (umbrella organization that supports multiple partnerships of various types); 3 = Sponsored Partnership (initiative that has a lead partner that sets the agenda and typically provides a large share of the resources [science, funding, staff] that animate the partnership). Most initiatives (92 percent) were classified as 1, Collaborative Partnership.

Figure 7: Number of Survey Respondents by Initiative Classifications



The nature of initiatives' work

Question: Our landscape conservation initiative is primarily focused on (select one of the following options): 1)Directly advancing conservation, stewardship, restoration, and/or management actions within a landscape; 2) Building the "infrastructure" that is indirectly but critically essential to advancing conversation, stewardship, restoration, and/or management within a landscape [for example, synthesizing science and data across scales; providing technical assistance and expertise; supporting and building capacity in a range of landscape conservation initiatives, etc.]

The majority of initiatives that indicated they are integrating climate (mitigation, adaptation, or planning) (59 percent) responded that their work is directly advancing conservation, stewardship, restoration, and/or management actions within a landscape, and 41 percent of initiatives' work is building the "infrastructure" that is indirectly but critically essential to advancing conversation, stewardship, restoration, and/or management within a landscape.

Figure 8: Number of Organizations by the Nature of Their Work